OPINION

by Professor Nikolay M. Yanev, Dr.Sc.,
Institute of Mathematics and Informatics, BAS,
member of a scientific jury in a competition for
the academic position of "Professor" at IMI-BAN
4.5. Mathematics, „Operations Research“ (Financial mathematics)
section „Operations research, Probabilities and Statistics “,
according to the competition announced
in „State Gazette “, no. 63/10/07/2026

I. Applicant requirements and documentation

Sole candidate for participation in the above-cited competition is **Associate Professor Tsvetelin Stefanov Zaevski**, **PhD**, **Dr.Sc.,** who currently holds this position at IMI-BAN, Section „Operations Research, Probability and Statistics “. The candidate is admitted to participate in the competition by a Commission appointed by order of the Director № 93/09.09.2026.

For evaluation, 21 documents (or sets of such) are presented in the competition, which are detailed in an application for participation in the competition. Here are some of the more essential ones: curriculum vitae, diplomas, list of publications and copies thereof, reference for contributions and citations, reference for the fulfilment of the minimum national requirements and of the additional requirements, etc., all in great detail and duly formed, which gives me reason to accept them for consideration and to find that all the formal requirements under the procedure have been met.

The curriculum vitae of the candidate (in 5 pages) was prepared in accordance with the requirements according to the European model and contains data on a number of serious achievements. Here are some of them in a nutshell.

In 1999. Tsvetelin Zaevski graduated with a master's degree from FMI-SU, majoring in Applied Mathematics, and in 2013 acquired a „Doctor“ in 4.5. Mathematics (Operations Research), defending a dissertation at FMI-SU on the topic „Combined processes of Ito and Levi“ with supervisor Professor Racho Denchev. In 2025, he defended his dissertation on „Method for evaluating an American type of derivatives“ for „Doctor of Science“ in Mathematics at IMI-BAN. Since 2014, he has been working at IMI-BAN, and since 2021 he has been an associate professor. He has a serious teaching activity at FMI-SU as a part-time assistant and lecturer, as well as two published scientific aids.

Tsvetelin Zaevski has participated in 8 research projects, of which 3 are in FNI. The list of scientific publications contains 63 scientific articles, of which 54 in journals with IF or SJR, the citations noted are 220, of which 165 in WoS or Scopus. He has presented 8 papers at international conferences. He is the author of 3 scientific and applied achievements of IMI-BAN for 2019, 2022 and 2023. Let's note in particular that Ts. Zaevski was the scientific supervisor of a doctoral student with a successfully defended dissertation at IMI-BAN.

The scientific interests of Tsvetelin Zaevski are generally speaking in the fields of operations research, financial mathematics, probability theory, mathematical statistics and stochastic processes. To participate in the competition Tsvetelin Zaevski has submitted 16 articles with impact factor (IF) or impact rank (SJR) refereed and indexed in Web of Science and Scopus that have not participated in previous competitions. They have the following distribution by quartile (in the year of publication): Q1 - 6, Q2 – 6, Q3 - 4. The citation reference of these articles contains 99 citations, all in journals of impact factor or rank. Detailed summaries of the

presented publications in Bulgarian and English are presented. There is also a detailed reference to the original scientific contributions. This scientific production will be more fully analyzed in the next section.

The report on the fulfillment of the minimum national scientific requirements is presented in detail on 20 pages and shows that Ts. Zaevski has 1381 points with a required minimum of 660 points, i.e. the latter has been exceeded 2 times, as can be seen from the following table:

Groups	A	IN	D	D	E	TOTAL
Minimal	50	100	220	140	150	660
Received	50	150	406	594	181	1381

From the inspection, there is no finding of absence or presence of violations in the procedure and of inadmissibility of the candidate until the competition. On the contrary, the high quality of the submitted materials for the competition and the complete satisfaction of all formal regulatory requirements are obvious. All this gives me reason to proceed to the following sections, according to the relevant regulations.

II. Research analysis and scientific and applied activity

As already noted, the 16 articles presented in the competition have been published in a number of renowned international publications with impact factor or impact rank. All these articles were published in the period 2022-2026 and did not participate in other procedures. Of these, 6 are independent and the others have co-authors as follows: 8 with one co-author, 1 with two co-authors and 1 with four.

In the attached scientific reference C. Zaevski has divided the presented articles into 3 groups:

1. Study of various modifications of the Keyes distribution (articles [1-5]).
2. Identifying chaos in perturbed dynamical systems (article [6]).
3. Financial mathematics (articles [7-16]).
   (a) Risk analysis and management [7-9].
   (b) American type derivatives [10-15].
   (c) Yield curve [16].

This reference to the original contributions is presented on 26 pages. In addition, the proposed summaries of the articles in English and Bulgarian on 18 pages briefly give the main directions of research and explain some of the main results. All of them are clearly and thoroughly presented and outline an undoubtedly serious scientific production with a serious international presence and recognition. A number of serious lemmas and theorems have been proven in several fields and which find interesting applications in financial mathematics.

In the first group (articles [1-5]) various modifications and properties of the Kies distribution are considered, which is of interest to financial mathematics. From a stochastic point of view, it is defined by the famous Weibull distribution, of which the exponential is a special case. More precisely, if the random variable W in $(0, \infty)$ has a Weibull distribution with the positive parameters (λ, β), then the random variable $K=(a+bW)/(1+W)$ has a Kies distribution in the interval (a, b) with parameters (λ, β, a, b), $a\geq 0$. In article [1] some refinements and corrections are given to this model in works of other authors and at work [2] the important special case is examined $(\lambda, \beta, 0,1)$ and a number of interesting properties have been found for the distribution function $F(t) := G(H(t))$, where G(t) and H(t) are Keyes distribution functions. Hausdorff saturation **d** is studied, which is the only solution to the equation $F(x)=1-x$. Article [3] examines the random variable $\mathbf{K}=\min\{K(1), \ldots, K(n)\}$, where K(i) are independent Keyes random variables with parameters $((\lambda(i),\beta(i),a,b)$. A number of interesting claims have been proven. In

particular, the Γ-function is shown to be a mathematical expectation in a special Kies transformation distribution. In [4], Kies distributions are considered (λ,β,0,1) with randomized parameters. Some particular cases where randomization has binomial, geometric and Beta distributions, respectively, are also studied. In [5] trigonometric transformations of Keyes distributions are studied. In all cases under consideration, the corresponding Hausdorff saturation is also found.

Let's note that the results obtained in this field outline a new methodology for the study of Kies distributions and will undoubtedly attract more and more the interest of specialists in stochastics and financial mathematics.

The second group of results are based on an article [6], published in Axioms. The prediction of chaos in a dynamic system of the epidemiological model type (SIOR) is studied. Now this model is generalized with the introduction of N free parameters using the Melnikov method appropriately. This model is also studied in a stochastic variant when the coefficients are interpreted as a probability distribution. As concrete examples, uniform distribution in a finite interval and normal distribution are considered. Various examples and simulations are given, presented with interesting graphs. It has been noted that this approach could also be applied to other epidemic models such as SIR/SIRD/SEIR/GSEIR.

In the third group (divided into three subgroups), 10 articles [7-16] are presented that examine stochastic processes and models inspired by some areas of financial mathematics, mostly related to risk analysis and management, derivative valuation and bond market analysis.

The first subset of articles [7-9] addresses issues related to financial risk analysis and management. Thus, [7] proposes a new risk measure using the so-called expectiles, which in a sense appear as analogies of classical quantiles. Five stochastic models are considered, starting with the classic Black-Scholes model and also his generalizations of Heston and Bates. The following are Exponential Modified-Stable (Sustainable) Model and a model with stochastic volatility and modified stable jumps proposed by Zaevski, Kim and Fabozzi (2014). Let's note that these models are described by stochastic equations. The results obtained are calibrated with real data and interesting graphs are presented. In [8] for the Heston model with stochastic volatility, the function giving rise to the moments is investigated. These results are on the other hand used in work [9] where the entropy value at risk for the five described models is studied. Calibrated parameters on real data are presented in tables and the behaviour of models are illustrated in graphs.

The second subgroup covers six articles [10-15], dedicated to the so-called American type derivatives, which in turn are divided into two subtypes – ordinary and cancellable. The classic Black- Scholes model is used as the main asset is from a log-normal process. Let's note that five of these articles are stand-alone, and [11] is a collaboration with two co-authors.

In articles [10-12] ordinary American derivatives are considered. Thus, in [10] optimal limits are found for futures contracts under four different schemes - when the time to maturity tends to 0, for open-ended futures ($T = \infty$), by first reaching a level of Brownian motion, by the Crank-Nicolson method. In [11] financial instruments with payoff with power options are analyzed. Optimal limits and option prices are found. Interesting numerical examples are given. In [12], sub-optimality is defined (when the possessor does not exercise when reaching the optimal limit), where an ε-optimal limit is found for call options and its properties are investigated. The put options are treated similarly.

In [13-15], cancellable American options are explored that can also be interpreted as part of game theory. Thus, in [13] the optimal sets and the optimal bounds are found. A method for approximating the optimal limits has been proposed. Article [14] appears in a sense as a continuation of the previous one. A characterization of critical levels at final maturity has been proposed and a method found to find the critical values of the coefficients characterizing the penalty in open-ended options. In [15] there is a duality between cancellable put and call options under the assumption of three-component penalties – proportion of a standard payoff option, shares of an underlying asset and a fixed amount. Existence and uniqueness of optimal limits has been proven.

The results of the third subgroup are based on article [16], where yield curves are considered from data from the primary market of government securities in illiquid bond markets, which is motivated by the specifications of the Bulgarian government securities market. Two stochastic models are used: Vasicek's and Cox–Ingersol–Ross.

Let us note that in the entire third group, a very serious and diverse mathematical technique is used – stochastic analysis and stochastic differential equations, skillful use of various types of stochastic processes and functionals thereof, characteristic functions and functions of moments, optimization methods and simulations are applied. The resulting theoretical results are applied to real data and illustrated with interesting graphs.

Everything presented in this section of the review gives me reason to conclude that the scientific production and scientific-metric indicators of the candidate Tsvetelin Zaevski are at a high level and undoubtedly fully meet all the conditions for occupying the requested academic position «professor».

IIII. Opinions, recommendations and notes

I have been following the scientific development of Tsvetelin Zaevski for a long time and I have excellent impressions of his reports at seminars and conferences.

I would recommend Ts. Zaevski to maintain his high pace in scientific development by trying to attract more graduates and graduate students to the interesting topic he is considering. I would also recommend that he deepen and supplement with the new results his major doctoral dissertation by forming it into a monograph to be published in some prestigious international publishing house.

I would further recommend that he give a paper at the National Seminar on Stochastics on the latest results in this issue and specifically on the Kies distribution.

IV. Conclusion

As already emphasized in the previous sections, Tsvetelin Zaevski's scientific production is at a high scientific level, as well as his scientific and metric indicators, which far exceed the minimum requirements. He is a „Doctor of Science“ in the field of competition and has appeared in a number of scientific and scientific-applied projects. Under his supervision, a doctoral dissertation was successfully defended. His teaching activity at the FMI of Sofia University is at a high level, and he is the author of two scientific instruments. Tsvetelin Zaevski is an internationally recognized specialist in the field of stochastic models in financial mathematics with publications in a number of renowned journals with a high impact factor and collections with impact rank, which also have serious citation. In general, we can conclude that the presented scientific production covers a wide range of models that also have serious applications.

Everything presented so far gives me definite reason to conclude that the only candidate **Associate Professor Tsvetelin Stefanov Zaevski, Dr. Sc.,** satisfies without a doubt all the conditions of the competition thus announced for the academic position **„Professor“** at IMI-BAN and I call on the Scientific Jury and the Scientific Council to vote positively for his election.

Date: *02.11.2026.* **REVIEWER:**

/professor dmn Nikolay M. Yanev/