

STANDPOINT
on the competition for the academic position of „professor“
in the field of higher education „Natural sciences, mathematics and informatics“,
professional field 4.5. Mathematics. (Probability theory and mathematical statistics),
for the needs of Shumen University „Bishop Konstantin Preslavski“ (SHU),
Faculty of Mathematics and Informatics (FMI),
announced in State Newspaper no. 63 of 08/06/2022 and on the website of FMI of SHU

by Prof. Dr.Sci. Maroussia Nikiforova Bojkova, Department of Probabilities, Operations Research and Statistics at the Sofia University „St. Kliment Ohridski“ (SU)-Faculty of Mathematics and Informatics (FMI) on the basis of the Order No. 68-201/4.10.2022 of the Rector of SHU

Associate Professor Dr. Pavlina Kalcheva Jordanova is the only candidate in the competition.

I. General description of the competition documents

1. Application details

The set of documents submitted for participation in the competition are in accordance with the requirements of the Academic Staff Development Act (ZRASRB), the Regulations for the implementation of the ZRASRB and the Regulations for the development of the academic staff at Shumen University „Bishop Konstantin Preslavski“.

To participate in the competition, the candidate Pavlina Jordanova submitted a list of a total of 24 titles, including 21 publications in Bulgarian and foreign scientific journals, 20 of which are visible in the international databases - SCOPUS and/or Web of Science, 1 monograph with title "Probabilities for p -outside values and heavy-tails" in English, 1 co-authored textbook titled "Statistical Modeling of Probability Distributions with Excel" and 1 manual on probability theory. A variety of other documents are also submitted, including job memos and certificates from an employer, project manager, references and testimonials, awards and other relevant evidence supporting the applicant's achievements. All the documents required for the procedure are properly prepared.

2. Applicant's data

The candidate graduated in 1996 with a master's degree in Mathematics with specialization in Econometrics at the Faculty of Mathematics and Informatics, at SHU. In 1998, she also acquired a pedagogical specialty from the same university, and in 2006, she defended her dissertation on the topic "Multidimensional Functional Extremal Criterion" and obtained the Ph.D. degree in Mathematics from the Institute of Mathematics and Informatics at the BAS. Associate Professor Dr. Jordanova began her academic career at SHU as an Assistant professor in probability theory and mathematical statistics, then passing through senior (2002) and chief assistant (2004) she obtained her habilitation in 2014 and until now takes this position again at SHU. Over the years, she has continuously upgraded her competencies and skills in various courses and specializations. For her achievements in 2019, she was awarded with distinction for achieved significant scientific results and publications in prestigious international journals by UBM - Shumen section.

3. General characteristics of the scientific and applied contributions of the applicant

The scientific works of the candidate meet the minimum national requirements (according to Art. 2b, § 2 and 3 of ZRASRB) and, accordingly, the additional requirements of the Regulations for the development of the academic staff at Shumen University „Bishop Konstantin Preslavski“ for occupying the academic position of "professor" in the scientific field and professional direction of the contest. The total number of articles submitted for participation in the competition is **20 scientific publications** and **1 article that is an editorial introduction** (article 21), of which **13 have an impact factor (IF)** and **7 have a Scimago Journal Rank (SJR) on Scopus**. The presented publications have been published in prestigious scientific journals in the field such as: Journal of Applied Statistics, Stochastic Analysis and Applications, Lecture Notes In Computer Science, Applied Mathematical Modeling, American Institute Of Physics Conference Proceedings, etc.

All these works were published after the competition for the Assoc. Prof. (2014) and were not used under a previous procedure for acquiring the Ph. D. degree and are in English. The results of her research have been reported at: the National Seminar on Stochastics at IMI-BAS, Johannes Kepler University in Linz, Austria, University of Aveiro, Portugal, Federico Santa Maria University, Valparaiso, Chile, 60th World Congress on Statistics in Rio de Janeiro, Brazil, the 6th International Conference on Risk Analysis in Barcelona, Spain, the 15th International Summer Conference on Probability and Statistics in Pomorie and others.

The presented scientific works **fully meet and exceed many times the minimum national requirements** (according to Art. 2b, § 2 and 3 of ZRASRB) and also the additional requirements of the SHU for occupying the academic position of „professor“ in the scientific field and the professional direction of the contest. No plagiarism was found in the scientific works submitted for the competition. Of the publications presented in the competition, the candidate has 3 independent ones, and of those in co-authorship, she is the first author of 14 of them. For the joint articles, as can be seen from the attached documents, Jordanova's contribution is equal to that of the other co-authors. Also, from the attached documents for the competition, it is clear that the candidate participated in 2 international scientific and scientific-applied projects, one of which she was the head of, and 21 national ones, 6 of which she was the head of. Her activity as an editor and reviewer for a number of highly renowned journals such as: Journal of Applied Statistics, Mathematics, Symmetry, Communications in Statistics - Theory and Methods, Extremes, Applied Mathematical modeling, Insurance: Mathematics and Economics, etc. is impressive. She participated with reports in 42 international and national conferences.

4. Characteristics and assessment of the candidate's teaching activity

Assoc. Prof. Jordanova has extensive teaching experience, which is evident from the attached references. In short, she is reading courses in Probability Theory, both for bachelors spec. Business Mathematics, Mathematics, Computer Informatics, Computer Information Technology, Probability and Statistics Part II; Economics and Mathematics; Random processes; Statistics; Statistics with Excel; Econometrics and others in the relevant specialties of the SHU, mainly for third and fourth year students, as well as the analogous ones for masters degree students with the corresponding difficulty and depth. There are a total of 6 graduates and she is the head of the Master degree program of Statistics and Econometrics. To this we must add the attached textbook and manual on Probability Theory, accompanying her pedagogical practice, not only when conducting lectures, but also as an assistant when conducting seminar and laboratory exercises.

5. Content analysis of the applicant's scientific and applied scientific achievements contained in the materials for participation in the competition

The presented scientific works and corresponding achievements of Assoc. Prof. Jordanova can be grouped as follows: *in the field of theoretical study of p -probabilities for external values in different distributions; creating statistics for extreme value estimates; in the field of dynamic series analysis; in mathematical modeling of random processes in insurance and assessment of the probability of bankruptcy and applications related to them, which fully coincides with the scientific specialty of the competition.*

I will focus on the presented monograph, which contains part of the candidate's main theoretical contributions. It is dedicated to obtaining the probabilities for left and right p -outside values, where through their inverse functions with respect to the unknown parameters, IPO (Inverse Probabilities for Outside values) and IPO-NM (if numerical method (Numerical Method is used) estimates are defined and studied. These statistics allow to estimate the values of the parameters that govern the behavior of the tail of the observed distribution function without prior information about the center and the scale parameters. The main contributions of the candidate consist in defining and investigating the basic properties of the probabilities for left and right p -outside values and p -fences for which the formulas for p -outside values are derived in the most important particular cases. Using the Monte Carlo method, there have been observed cases where the IPO-NM estimators outperform other well-known estimators of the same parameters. The general formulas for the probability distributions of the number of left and the right-hand p -outside values in a sample of independent observations, as well as various asymptotic properties of these estimates, are obtained. By using appropriate transformations of the r.v. other strongly consistent estimates are derived for the parameters that govern the behavior of the tail of the observed r.v. In the case of the Pareto, Fréchet, Log-logistic and Hill-Horror distributions, unbiased, asymptotically efficient and asymptotically normal estimators and the formulas for their densities and variances are found, allowing the construction of confidence intervals.

For the sake of completeness, we note that only distributions with properly varying tails with parameter $\alpha > 0$ were considered separately. The obtained estimates depend on the type of the investigated quantity and are based on the logarithms of various quotients of the ordered statistics of the sample. In their formation, Hill's approach was followed, but instead of an arithmetic mean of the logarithms of the above order statistics, their specific transformations were used. Using relevant air pollution data considered in other authors' previous studies and comparing the own results with theirs, the utility of the proposed p -outside values probabilities and IPO-NM estimators is illustrated. Another merit of the results is that they are suitable both for working with large samples and for working with small and medium samples.

A significant contribution is made by the candidate's results regarding one of the main questions in the theory of extreme values, namely **the estimation of the distribution function and quantiles of the observed quantity, outside the range of the data**. A new approach is proposed to construct parameter estimates that determine the behavior of the extreme values of the observed quantity even when it depends on more than one parameter, or when the quantile function does not have an explicit form. It is based on inverting the probabilities for p -outside values and pre-estimating the p -bounds.

In the field of mathematical modeling of random processes in insurance and assessment of the probability of bankruptcy, one of the candidate's contributions consists in the introduction of general "multivariate" processes of insurance risk, which are stochastically equivalent to the well-known univariate Cramer-Lundberg process and in at the same time, they are a generalization of the risk processes with common shock influences, the Poisson risk process of degree k , the negative binomial risk process, the risk process with Polya-Aeppli or with Polya-Aeppli of degree k , etc. Another contribution is the simulation investigation of multidimensional composite sums with one and the same number of summands, which are distributions of the time intersections of the claims counting processes in multivariate risk processes. A significant contribution in this direction is the research related to approximating risk processes with a mixture or those in which there is no dispersion of insurance claim sizes.

Regarding the contributions related to the improvement of existing time series analysis methods, the obtained results attempt to overcome the main shortcoming of many of the time series analysis approaches, namely that they only allow the prediction of separate numerical characteristics of the random process. Jordanova's results allow for a full characterization of the considered processes, preserving the possibility of a non-linear trend, which was achieved through a non-random transformation of time. The results in this direction are related to the modeling of contemporary interest rates on deposits and loans and are applied to real data from three dynamic series of interest rates on consumer loans of the Central Bank of Chile.

The scientific results of the candidate are known to scientists in the field. Assoc. Prof. Jordanova has attached a reference for 48 noticed citations, of which *46 are in journals referenced in SCOPUS and WoS* and 2 are in journals referenced in other databases.

In conclusion, the presented publications and monograph contain **new and original theoretical and scientific-applied results, at a high scientific level in the field of probability theory and mathematical statistics**. The research area is **wide-ranging** and includes theoretical development, application and improvement of existing methods both in the field of p -probabilities for outside values in various distributions and in the creation of extreme value estimation statistics, dynamic series analysis and mathematical modeling of random processes in insurance and estimating the probability of bankruptcy.

6. Critical notes and recommendations. Rather, I have a wish for the candidate – to devote part of her efforts to working with doctoral students, to whom she certainly has something to convey from her experience and further ideas for development in the field.

7. Personal impressions of the candidate I know Assoc.Prof. Jordanova from her doctoral studies at IMI-BAS as an extremely inquisitive and talented young scientist, as well as from her numerous subsequent appearances at scientific seminars and conferences in our country. She was a participant in a project that I managed and I have immediate impressions of the initiative, persistence and professionalism with which she approaches solving the tasks assigned to her. She has left an excellent impression on me academically and also as a fair and cooperative member of the team.

8. Conclusion on the application

Having acquainted myself with the materials and scientific works presented in the competition and based on the analysis of their significance and the scientific and scientific-applied contributions contained in them, **I confirm** that the scientific achievements meet the requirements of ZRASRB, the Regulations for its application and the relevant Regulations of the SHU "Episkop Konstantin Preslavski" for the candidate's occupation of the academic position of "professor" in the scientific field and professional direction of the competition. In particular, the candidate satisfies the minimum national requirements in the professional direction and no plagiarism has been found in the scientific works submitted for the competition.

I give **my positive assessment** to the application.

II. GENERAL CONCLUSION

On the basis of the above, I recommend the Scientific jury to propose to the competent authority of the Faculty of Mathematics and Informatics at SHU "Episkop Konstantin Preslavski" to select Pavlina Kalcheva Jordanova to take the academic position of "professor" in professional direction 4.5 Mathematics.

Sofia, 16 November 2022

Sign:

Prof. Maroussia Bojkova
Department of Probability, Operations research and Statistics
Faculty of Mathematics and Informatics
SU "St. Kl. Ohridski "