REPORT

for competition of academic position of 'Associate Professor' for the needs of IMI - BAS,
announced in State Gazette issue 108/22.12.2020.
Professional direction: 4.5 'Mathematics',
Speciality: Probability theory and mathematical statistics

by a member of the Academic Jury, Prof. Dr. Sc. Eugenia Stoimenova from the Institute of
mathematics and informatics - BAS

I am presenting my report related to this procedure as a member of an Academic Jury,
formed with Order No. 28/19.02.2021 of the Director of IMI. One applicant has presented the
required documentation for participation in the procedure: Dr. Tsvetelin Zaevski.

1. General description of the presented materials

Dr. Tsvetelin Zaevski has presented 10 scientific publications for participation in the
competition. All of them have been published in specialized international scientific journals
and were published after the defended doctoral dissertation in 2013. The articles are grouped
by impact factor as follows:

- 5 articles are in Q1 category of Impact factor journals
- 1 article is in Q3 category of Impact factor journals
- 3 articles are in Q4 category of Impact factor journals
- 1 article is in ANNUAL OF SOFIA UNIVERSITY

The list of 28 citations provided is for 7 articles of the candidate. The presented materials
have been prepared in accordance with The Law Act for Development of the Academic Staff
in the Republic of Bulgaria (LADAS); The Statutes for application of LADAS, as well with
accordance of the specific requirements of BAS and IMI-BAS. The reference for the fulfillment
of the minimum national requirements and the requirements of IMI-BAS for the academic
position of Associate Professor indicate that the applicant satisfies the requirements for this
position.

2. General characteristics of the applicant's scientific activities

Tsvetelin Zaevski graduated in Applied Mathematics, specialization in Mathematical Eco-
nomics, from the Faculty of Mathematics and Informatics at Sofia University "Kliment Ohridski"
in 1999. In 2013 he obtained PhD degree in Mathematics. Since 2014 he has been working at
IMI-BAS as an assistant.

Dr. Tsvetelin Zaevski is an established specialist in stochastic modeling with significant
results in the field of mathematical modeling in the finance. He is actively involved in national
research projects funded by the NSF.

3. Scientific and applied scientific achievements

The presented description and proofs of the scientific and applied scientific contributions
of Dr. Tsvetelin Zaevski are in accordance with the scientific specialty in Probability theory
and mathematical statistics. The candidate has classified his work into five thematic groups:

1. Stochastic volatility models with jumps driven by a Lévy process.
2. Finding the related elements of a set.

3. Weak path dependent financial derivatives.
4. Financial derivatives with early exercise rights.
5. Laplace transforms for thee first hitting moment of the Brownian motion.

The first group of papers includes one co-authored article published in the International Review of Financial Analysis. The article proposes a stochastic model of volatility in option pricing that exhibits Levy jump behavior. A general formula for a European call option is derived for this model. A special case of this class of models is the Bates model, for which the jumps are modeled by a compound Poisson process with normally distributed jumps. Infinite activity jumps produced by a tempered stable process have been studied. The estimated density of the probability of returning the log-return and the price of an option are empirically compared. It is found that tempered stable jumps describe market prices more accurately than the compound Poisson jumps assumed in the Bates model.

The second group includes an article that I will not comment on, as I am one of the co-authors of the candidate. Dr. Zaevski has a leading role in it.

The third group includes two articles on weakly path-dependent financial derivatives. A method for pricing the so-called default derivatives has been proposed, which is based on the assumption that bankrupt occurs at the moment of the first jump of a stochastic process. The price of the asset is defined as the solution of a stochastic differential equation driven by a jump process. The second article proposes two different schemes for deriving partial differential equations for the price of derivatives through the so-called defaultable derivatives. In the first scheme, the asset price is presented as a solution of a stochastic differential equation with random stopping. The second scheme is driven by a jump process, assuming that the stop time is the moment of the first jump of the second process. The loss rate, which represents the loss of the asset at the default moment, is studied. In both schemes, different assumptions and relationships between the underlying asset, the stopping time and the loss rate were investigated. An example of the price of a contingent convertible bond where the formula has a closed form is considered.

The fourth group includes 5 articles divided into two subgroups. The first article proposes a new form of so-called early exercise premium for American-type derivatives. The decomposition presented consists of a European derivative and a derivative with a stochastic maturity. In various specific cases, the familiar form of the American put option appears, where the underlying asset is driven by a Brownian motion or a Levy process. The second article proposes a new approach for deriving the early exercise boundary of American put options. Several examples are given, where in particular cases the validity of the procedure is confirmed by comparison with other numerical methods for pricing American put options. The other three articles are devoted to game options, which are explored through a new approach based on auxiliary derivatives. In addition to the properties of American options, game options give the seller the right to cancel the contract at a time specified by him. An additional discount factor has been introduced, which sets a time dependence in the payment structures. Through it, a model with paying dividends can be presented as a model without dividends. Call and put options are considered, for which the amount that the seller owes for early exercise is constant. The equations for the optimal limits are derived and it is proved that they have a unique solution. A special type of game option is considered, the main feature of which is the right to early exercise by both the seller and the buyer. A new approach is proposed in which the early exercise of the issuer is proportional to the usual payment of the option. The corresponding equations for the optimal limits are derived and it is proved that they have

unique solutions.

The fifth group includes one article in which some properties of the Laplace transform related to the first hitting time to piecewise linear functions of a Brownian motion are derived. The results are used in the pricing of financial derivatives related to reaching certain limits of the underlying asset - such as barrier or American options.

All these investigations of Tsvetelin Zaevski are from the field of the announced competition.

4. Reflection of the candidate's work in the works of other authors

The applicant's documents provide a list of 28 citations of the publications submitted for the competition. Most of them are in scientific journals with an impact factor. I will mention in particular one of the articles, which has 18 citations by other authors. The quantity and quality of citations fully satisfies the specific requirements of IMI-BAS.

5. Impact of the candidate in collective publications

Four of the 10 publications submitted submitted for this competition are co-authored. I think, as a general assessment, that Dr. Tsvetelin Zaevski has at leastequal impact in each of them.

6. Critical remarks

I have no significant critical remarks. The documents are carefully prepared and do not complicate the assessment.

7. Personal impression of the candidate

My personal impressions of Tsvetelin are excellent as a colleague and a specialist in probabilities and statistics. He works actively on IMI projects and research events.

Conclusion

The analysis of the submitted materials in the competition shows that Dr. Tsvetelin Zaevski is a highly qualified researcher who has significant contributions in the field of probabilities and statistics. I believe that the set of criteria and indicators for the acquisition of the title "Associate Professor" is satisfied in accordance with the LADAS

I recommend the Scientific Jury to propose to the Scientific Council of IMI to elect Dr. Tsvetelin Zaevski as a Associate Professor in professional field 4.5 Mathematics, scientific specialty Probability theory and mathematical statistics.

Sofia, 19 април 2021 г.   Signed:

                                                                    Eugenia Stoimenova