

## **Bucharest University of Economic Studies (UES)**

### **ANNOUNCEMENT**

The Bucharest University of Economic Studies is organizing a selection for the following vacancy:

**Experienced researcher - 1 - 3 – (3 positions)** – within the „*Non-Gaussian self-similar processes: Enhancing mathematical tools and financial models for capturing complex market dynamics*”, project code 194/31.07.2023

Part-time work of maximum 44 hours/month, distributed unequally, gross hourly salary 57.96 lei, fixed period of 12 months with evaluation and possibility of extension until June 30, 2026.

#### **A. To participate in the competition, candidates must meet the following general and specific conditions:**

##### **1. General conditions:**

- a) has Romanian nationality, citizenship of other Member States of the European Union, of States belonging to the European Economic Area and/or foreigners as they are defined by Art. 2 lit. a) of OUG 194/12.12.2002 with subsequent amendments and additions, respectively persons who do not have Romanian citizenship, citizenship of another Member State of the EU or the citizenry of the Swiss Confederation;
- b) has the minimum statutory age;
- c) has full capacity to work;
- d) meets the study conditions and, where appropriate, seniority or other specific conditions according to the requirements of the position put up for competition;
- e) has not been definitively convicted for committing a crime against humanity, against the State or against authority, or for an offence committed in the course of or in connection with the performance of his or her duties, which obstructs the course of justice, or for forgery or acts of corruption or a crime committed with intent, which would make him or her incompatible with the exercise of the function, except for the situation in which rehabilitation intervened.

##### **2. Specific conditions:**

- a) level of studies in progress: higher doctorate
- b) field of study: branch of science
  - mathematics and natural science, mathematical field
- c) Other specific conditions:

## Abilities:

### *1. Technical skills:*

- Deep understanding of the fundamentals and applications of stochastic processes, including detailed knowledge of self-similar processes and Hermite processes.
- The ability to analyze and model the random behavior of these processes in various contexts, such as price movements in financial markets.
- Familiarity with concepts such as fractional brownian movement, stationary increases, and long-term dependence.

### *2. Analytical skills:*

- Ability to analyze and interpret complex data, identify trends and formulate recommendations based on analysis.

### *3. Communication skills:*

- Excellent written and verbal communication skills, to present research results clearly and concisely.

### *4. Teamwork:*

- The ability to work effectively in an interdisciplinary team, collaborating with other researchers to the objectives of the project.

## Specific requirements

### *1. Foreign Languages:*

- Advanced knowledge of English (written as well as spoken) to be able to access and disseminate knowledge from international literature.

### *2. Scientific publications and contributions:*

- Applicants must demonstrate contributions and publications in the field of statistical mathematics and stochastic modeling that demonstrate research expertise and ability. It is considered an advantage if candidates demonstrate that they have publications in stochastic modeling with applications of stochastic processes in finance, in journals relevant to the scientific community,

### *3. Innovation Capacity:*

- An innovative attitude and creative thinking to develop new methods and tools.

### *4. Research Ethics:*

- Deep understanding of ethical principles in research and commitment to academic integrity.

### *5. Readiness for Professional Development:*

- Readiness to participate in conferences, workshops and other forms of continuous professional development.

### *6. Flexibility and Adaptability:*

- Ability to adapt to project direction changes and to respond to unexpected challenges.

**Candidates will present a portfolio of previous projects and relevant scientific publications to assess the quality and relevance of their experience, taking into account the required skills and requirements**

## **B. The selection will consist of:**

- 1. Step 1 - Evaluation of selection files;**
- 2. Step 2 - Structured interview** (in the situation where at least 2 candidates do not register, the competition committee can decide to simplify the procedure and carry out the selection without conducting the interview);
  - *the date and time of the interview*: to be announced at the same time as the results of the selection files evaluation are published;
  - *the place of the interview*: to be announced at the same time as the results of the selection files evaluation are published,

The tests are eliminatory, the minimum score for each test is 50 points.

## **C. Topics and bibliography:**

The thematic is designed to attract candidates with a deep theoretical understanding and the ability to apply knowledge in solving complex problems in finance, paving the way for significant innovations in the field.

### **1. Theme:**

- 1.1. In-depth understanding of Stochastic Processes:** Detailed knowledge of the theory of stochastic processes.
- 1.2. Advanced Mathematics:** Expertise in Stochastic Computing, Stochastic Differential Equations, Functional Analysis and Probability Theory. This knowledge is crucial for the development and analysis of complex mathematical models.
- 1.3. The theory and foundations of self-similar stochastic processes:** The fundamental theory of self-similar stochastic processes, with emphasis on the characteristics that define these processes such as self-similarity and statistical independence at scale. The analysis of fractional brownian motion as a primary example and the introduction of Hermite processes as non-gaussian extensions.
- 1.4. Modeling and analysis of Hermite processes:** The in-depth study of Hermite processes, including their mathematical derivation, statistical properties and applicability in financial data modelling. Discussing methods for estimating and simulating these processes.
- 1.5. Applications of stochastic processes in finance:** Explore how self-similar stochastic processes and Hermite processes can be used to model financial market volatility, asset price movements, and to assess financial risk. Analysis of the advantages and limitations of these models compared to traditional Gaussian approaches.
- 1.6. Development of new financial models based on Hermite processes:** Proposing and developing new financial models that integrate Hermite processes to capture the complex dynamics and long-term dependency observed in real financial data.

### **2. Bibliography:**

#### **2.1. Books:**

### **Fractals and scaling in finance**

Mandelbrot, Benoit B.

Sel. Works B. B. Mandelbrot

*Springer-Verlag, New York, 1997, x+551 pp.*

**ISBN:** 0-387-98363-5

### **MR2502480 - Option pricing in fractional Brownian markets**

Rostek, Stefan

Lecture Notes in Econom. and Math. Systems, 622

*Springer-Verlag, Berlin, 2009, xiv+137 pp.*

**ISBN:** 978-3-642-00330-1

### **MR4485442 - Continuous time processes for finance—switching, self-exciting, fractional and other recent dynamics**

Hainaut, Donatien

Bocconi Springer Ser., 12

*Springer, Cham; Bocconi University Press, [place of publication not identified], 2022, xviii+345 pp.*

**ISBN:** 978-3-031-06360-2; 978-3-031-06361-9

### **MR1422250 - Introduction to stochastic calculus applied to finance**

Lamberton, Damien; Lapeyre, Bernard

*Chapman & Hall, London, 1996, xii+185 pp.*

**ISBN:** 978-1-58488-626-6

### **Non-Gaussian selfsimilar stochastic processes**

Tudor, Ciprian

SpringerBriefs Probab. Math. Stat.

*Springer, Cham, 2023, xii+101 pp.*

**ISBN:** 978-3-031-33771-0; 978-3-031-33772-7

### **Normal approximations with Malliavin calculus**

Nourdin, Ivan; Peccati, Giovanni

Cambridge Tracts in Math., 192

*Cambridge University Press, Cambridge, 2012, xiv+239 pp.*

**ISBN:** 978-1-107-01777-1

### **Long-range dependence and self-similarity**

Pipiras, Vladas; Taqqu, Murad S.

Camb. Ser. Stat. Probab. Math., [45]

*Cambridge University Press, Cambridge, 2017, xxiii+668 pp.*

**ISBN:** 978-1-107-03946-9

## **2.2. Articles:**

### **MR4028644 - Pricing derivatives in Hermite markets**

Stoyanov, Stoyan V.; Rachev, Svetlozar T.; Mittnik, Stefan; Fabozzi, Frank J.

*Int. J. Theor. Appl. Finance* **22** (2019), no. 6, 1950031, 27 pp.

### **MR4577885 - Volatility is rough**

Gatheral, J.; Jaisson, T.; Rosenbaum, M.

World Sci. Lect. Notes Finance, 6  
*World Scientific Publishing Co. Pte. Ltd., Hackensack, NJ, 2023, 127–172.*

**Fractional Brownian motion with zero Hurst parameter: a rough volatility viewpoint**

Neuman, Eyal; Rosenbaum, Mathieu  
*Electron. Commun. Probab.* **23** (2018), Paper No. 61, 12 pp.

**MR4698114 - Short-Time Asymptotics for Non-Self-Similar Stochastic Volatility Models**

Giorgio, Giacomo; Pacchiarotti, Barbara; Pigato, Paolo  
*Appl. Math. Finance* **30** (2023), no. 3, 123–152.

**Local volatility under rough volatility**

Bourgey, Florian; De Marco, Stefano; Friz, Peter K.; Pigato, Paolo  
*Math. Finance* **33** (2023), no. 4, 1119–1145.

**Markovian approximations of stochastic Volterra equations with the fractional kernel**

Bayer, Christian; Breneis, Simon  
*Quant. Finance* **23** (2023), no. 1, 53–70.

**Stationary Heston model: calibration and pricing of exotics using product recursive quantization**

Lemaire, Vincent; Montes, Thibaut; Pagès, Gilles  
*Quant. Finance* **22** (2022), no. 4, 611–629.

**Fractional stochastic volatility correction to CEV implied volatility**

Kim, Hyun-Gyoon; Kwon, Se-Jin; Kim, Jeong-Hoon *Quant. Finance* **21** (2021), no. 4, 565–574.

**The overdamped generalized Langevin equation with Hermite noise**

Tudor, Ciprian A.  
*Fract. Calc. Appl. Anal.* **26** (2023), no. 3, 1082–1103.

**Generalized Wiener-Hermite integrals and rough non-Gaussian Ornstein-Uhlenbeck process**

Assaad, Obayda; Diez, Charles-Phillipe; Tudor, Ciprian A.  
*Stochastics* **95** (2023), no. 2, 191–210.

**Integration questions related to fractional Brownian motion**

Pipiras, Vladas; Taqqu, Murad S.  
*Probab. Theory Related Fields* **118** (2000), no. 2, 251–291.

**Central limit theorems for multiple stochastic integrals and Malliavin calculus**

Nualart, D.; Ortiz-Latorre, S.  
*Stochastic Process. Appl.* **118** (2008), no. 4, 614–628.

**Quadratic variation and drift parameter estimation for the stochastic wave equation with space-time white noise**

Assaad, Obayda; Gamain, Julie; Tudor, Ciprian A.  
*Stoch. Dyn.* **22** (2022), no. 7, Paper No. 2240014, 25 pp.

**Analysis of the Rosenblatt process**

Tudor, Ciprian A.

ESAIM Probab. Stat. 12 (2008), 230–257.

**Variations and estimators for self-similarity parameters via Malliavin calculus**

Tudor, Ciprian A.; Viens, Frederi G.

Ann. Probab. 37 (2009), no. 6, 2093–2134.

**The linear stochastic heat equation with Hermite noise**

Slaoui, Meryem; Tudor, C. A.

Infin. Dimens. Anal. Quantum Probab. Relat. Top. 22 (2019), no. 3, 1950022, 23 pp.

**Asymptotic expansion for vector-valued sequences of random variables with focus on Wiener chaos**

Tudor, Ciprian A.; Yoshida, Nakahiro

Stochastic Process. Appl. 129 (2019), no. 9, 3499–3526.

**Behavior of the Hermite sheet with respect to the Hurst index**

Araya, Héctor; Tudor, Ciprian A.

Stochastic Process. Appl. 129 (2019), no. 7, 2582–2605.

**D. Contents of the competition file:**

1. List of all attached documents;
2. Application form addressed to the Rector of UES;
3. Declaration regarding the existence/non-existence of situations of incompatibility;
4. Declaration on own responsibility if the applicant has / does not have a spouse or relatives and relatives, up to the third degree inclusive, who are employees of the Academy of Economic Studies in Bucharest in a position of management, control, authority with the post selected and neither the post to which he applies, is not in a leadership, control position with the spouse / wife or relative and related, until the third grade inclusive, university employees;
5. Statement for the processing of personal data;
6. Copy of the identity document or any other document certifying the identity, according to the law, if applicable;
7. Copy of marriage certificate or proof of the change of name, if the candidate has changed his/her name (proof of change of name);
8. The criminal record or a statement on his own responsibility that he has no criminal record that makes him incompatible with the position for which he is applying;
9. Medical certificate attesting the appropriate state of health issued no later than 6 months before the selection by the family doctor of the candidate or by the qualified health units, or the declaration on his own responsibility, with the obligation to complete the selection file with the medical certificate not later than the date of the first test of the recruitment and selection process, if applicable;
10. Curriculum Vitae in European format, RO/ENG– signed and dated on each page;

11. Copies of documents certifying the level of studies and other documents certifying the completion of specializations, as well as copies of documents proving that the specific conditions proving that the specific conditions for the position have been met;
12. Other documents relevant to the competition.

**E. Contact information:**

The selection files will be submitted in a literal format until 18.03.2024 at 16:00, at the ASE Registry, in the “Ion Angelescu” Building, Bastille Fall, ground floor, room 0016, or online at the address provided by the contact person.

Contact person: Maria Cristina Pădure - e-mail: [cristina.padure@ase.ro](mailto:cristina.padure@ase.ro)

The requested forms can be found on the website of the Project Management Service with Non-Restructible Financing, Resources section, by accessing the link <https://fondurieuropene.ase.ro/resurse/>

**F. The calendar of the selection process:**

No	Activities	Date
1.	Submitting the candidates' competition files at the ASE Registrar's Office and verification of the documents in the file	08/03/2024 – 18/03/2024
2.	Selection of application files by the members of the competition committee	19/03/2024
3.	Publication of the results of the selection of the application files	19/03/2024
4.	Submission of appeals regarding the results of the selection of application files	20/03/2024
5.	Publication of the results of the appeals	21/03/2024
6.	Interview	22/03/2024
7.	Communication of the results after the interview	22/03/2024
8.	Submission of appeals regarding the interview results	25/03/2024
9.	Publication of the results of the appeal	25/03/2024
10.	Publication of the final results	25/03/2024
11.	Appointment to the position	After approval from the Board of Trustees