



PRESENTATION of the MASTER 2  
Random Modelling, Finance and Data  
Science (M2MO)



UNIVERSITE PARIS CITE  
UNIVERSITY PARIS 1 - PANTHEON SORBONNE  
2024/2025



Program Directors: J.F. Chassagneux and S. Crépey (UPC)

E. Löcherbach (P1)

**2017:** 30th anniversary of the Master program (ex DEA Laure Elie)



More than one thousand graduated students



Laure Elie Alumni

# Objectives and main features

- High-level training in **stochastic and statistical methods** oriented towards the **applications**
- Specialisation in **finance, statistics and data science**
- In addition to a classical training in **quantitative finance**, emphasis is put on statistics with dedicated lectures in **statistics and finance, risk management, emerging markets and technologies**

- ① Random modelling in finance
- ② Data Science

# Prospects

## □ Professional

- Quantitative analysts
- Traders
- Financial engineers
- Risk and portfolio managers
- Activities related to market data
- Statistical engineers
- Data scientists

## □ Research

- PhD: in labs or industries (CIFRE)

- **Université Paris Cité**

- **LPSM**: Laboratoire de Probabilités, Statistique et Modélisation, Sorbonne Université et Université Paris Cité, CNRS, UMR 8001

<http://www.lpsm.paris>



- Team Mathématiques financières et actuarielles, probabilités numériques
- Team Statistique, Données, Algorithmes
- Team Structure et modèles aléatoires

- **University Paris Panthéon-Sorbonne (Paris 1)**

- **SAMM**: Statistique, Analyse et Modélisation Multidisciplinaire (EA 4543), University Paris 1

<http://samm.univ-paris1.fr>



# Partner Institutions



CentraleSupélec



## Industrial Partners and professional contributors

- Société Générale,
- BNP Paribas (Chaire)
- Crédit Agricole-CIB (Chaire)
- Natixis
  
- Goldman Sachs,
- Barclays,
- JP Morgan,
- Morgan Stanley,
- Bank of America
  
- Citadel,
- Capital Fund Management,
- Man AHL,
- Square Points Capital
  
- Etc.



**Bloomberg**



**Amundi**  
ASSET MANAGEMENT



## **STRUCTURE OF THE ACADEMIC YEAR 2024-2025**

- Starting: September 2, 2024
- Three terms with 8 weeks of lectures each
- Internship from April 7 to September 30, 2025.



# Curriculum

**60 ECTS**

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graph TD; A[60 ECTS] --> B[45 ECTS on master modules]; A --> C[15 ECTS for internship]; B --> D[18 ECTS (3 courses) of Mandatory modules]; B --> E[27 ECTS in Optional modules];
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**15 ECTS for internship**

**45 ECTS on master modules**

**18 ECTS (3 courses) of Mandatory modules**

**27 ECTS in Optional modules**

ENSAE 3A and CentraleSupélec (3A, option mathematics and Data science)

- Two mandatory modules ( $2 \times 6 = 12$  ECTS)
  
- Among the optional modules (33 ECTS),  
6 ECTS (i.e. 2 courses) can be validated by courses in their school (in a list in agreement with the studies director and program directors of M2MO)
  
- Stage de fin d'études can be validated as internship of the Master

# Course n° 1: Random modelling in finance

## ◉ **Core modules in term 1**

### ➤ **Mandatory 1: 6 ECTS**

- **Stochastic calculus and diffusion processes** - C. Labbé (TD: TBA)

### ➤ **Mandatory 2: 6 ECTS**

- **Derivatives modelling** – S. Crépey (TD: M.C. Quenez)

### ➤ **Mandatory 3** (except for ENSAE and CS): one course (6 ECTS) among

- **Markov chains** - N. Cunéo
- **Data modelling and statistical inference** – C. Lévy-Leduc (TD: S. Gribkova)
- **Introduction to Machine Learning** – A. Fisher

- ◉ **Optional modules (3 or 6 ECTS:** at least, two modules of 6 ECTS must be validated) organised according to the topics: **quantitative finance, risk in finance, statistics and machine learning in finance, numerical methods, emerging technologies, computer science.**

# Course n° 1: Random modelling in finance

## □ Quantitative finance:

- **Financial products** (3 ECTS) – B. Bruder (Amundi)
- **Quantitative assets management** (3 ECTS) – B. Bruder (Amundi)
- **Algorithmic trading** (3 ECTS) – O. Guéant
- **Stochastic control in finance** (6 ECTS) – M. Talbi
- **Nonlinear methods in finance** (3 ECTS) – M.C. Quenez
- **Advanced modelling in interest rate** (6 ECTS) - Z. Grbac
- **XVA analysis** (3 ECTS) – S. Crépey, B. Saadeddine (CACIB)

## □ Risks in finance:

- **Risk: regulation, measure and risk management** (3 ECTS) – N.Frikha, B. Hassani (Quant AI Lab)
- **Copulas and financial applications** (3 ECTS) – J.D. Fermanian

# Course n° 1: Random modelling in finance

## □ Numerical and computational methods

- **Monte-Carlo methods** (6 ECTS) – J.F. Chassagneux, M. Talbi
- **PDE in finance and numerical methods** (3 ECTS) - Y. Achdou, O. Bokanowski

## □ Emerging markets and technologies

- **Energy markets** (3 ECTS) – P. Gruet (EDF)
- **Green finance** (3 ECTS) – P. Tankov, T. Roncalli (Amundi)
- **FinTech** (3 ECTS) – L. Bertucci (ILB)
- **Quantum Computing in finance** (3 ECTS) - A. Jacquier (Imperial College London)

## □ Computer science

- **C++** (6 ECTS) - O. Carton (TD: V. Lejeune)
- **Statistical software** (3 ECTS) – S. Souchet

# Course n° 1: Random modelling in finance

## □ Statistics and machine learning in finance:

- **Time series analysis** (6 ECTS) – J.M. Bardet
- **Statistics of processes in finance** (6 ECTS) – A. Gloter and A. Kebaier
- **Point processes, and applications to finance** (3 ECTS) – E. Löcherbach
- **Statistics of industry and data science** (3 ECTS) – M. Abdel Sayed and L. Massoulard (Société Générale)
- **Prediction and sequential investment** (3 ECTS) – J.Y. Audibert (CFM)
- **Machine learning in finance** (6 ECTS) – H. Pham, J.D. Fermanian

## □ External courses (max 2x3 ECTS)

- **Calibration and volatility modelling** (3 ECTS) - J. Guyon (Ecole des Ponts)
- Course from the "Statistics and data science" track

# Course n° 2: Data Science

## **Mandatory modules (6 ECTS x3 = 18 ECTS)**

- **Data modelling and statistical inference** – C. Lévy-Leduc (TD: S. Gribkova)
- **Introduction to Machine Learning** – A. Fisher
- **Statistical learning** – S. Clemençon and E. Irurozki

## ⊙ **Optional modules (3 ou 6 ECTS):**

12 ECTS must be validated in UE Data science

# Course n° 2: Data Science

- Data Science (at least 12 ECTS)
  - **Optimization for learning** (3 ECTS) – G. Garrigos
  - **Markov chains** (6 ECTS) – N. Cunéo
  - **Statistics of industry and data science** (3 ECTS)– M. Abdel Sayed and L. Massoulard (Société Générale)
  - **Modern approach for dimension reduction** (6 ECTS) – A. Célisse
  - **Data Science projects** (3 ECTS) – C. Levy-Leduc
  - **Statistics in high dimension** (3 ECTS) – B-E. Chérif-Abdellatif
  - **Deep learning** (3 ECTS) – I. Giulini



# Course n° 2: Data Science

## □ Statistics and finance

- **Time series analysis** (6 ECTS) – J.M. Bardet
- **Prediction and sequential investment** (3 ECTS) – J.Y. Audibert (CFM)

## □ Computer science

- **C++** (6 ECTS) - O. Carton
- **Statistical software** (3 ECTS) – S. Souchet

## □ External courses

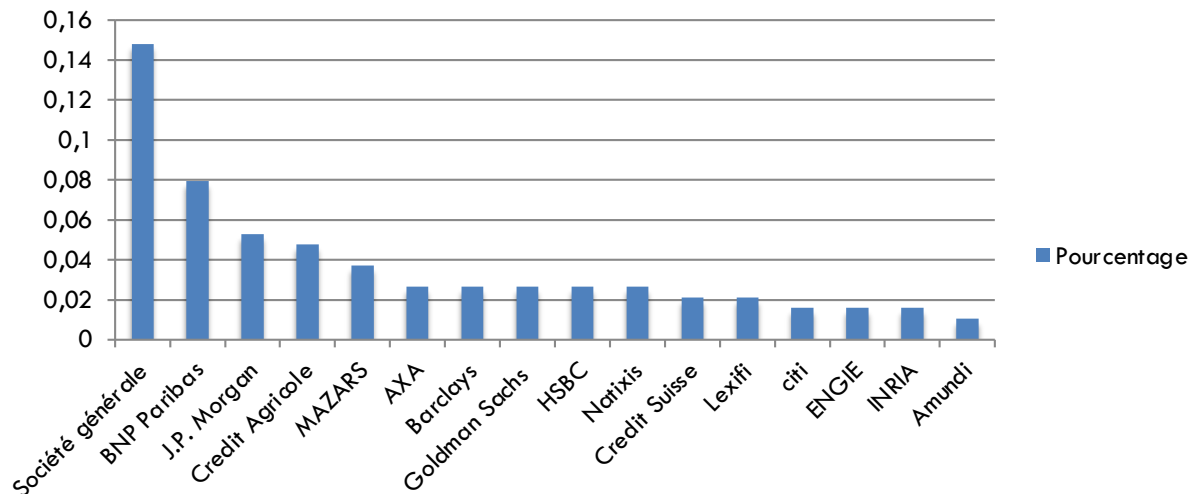
(max 2x3 ECTS)

# Internships

- - Internships must be validated by the pedagogical team  
(check the M2MO website for details)
  
- - Over the last years:
  - Main topics : 20% in Data Science, 79% in Finance (1/4 data oriented)  
and sometimes insurance
  
  - Main location: 75% in Paris, 20% in London
    - and US, Hong-Kong, etc.

# Internships: repartition by company

- A lot of diversity: **80 different companies** for the last three years
- The main ones (60%) being:



- **Some others:** Air france KLM, Altran Research, Bank of America Merrill Lynch BGF I Consulting, Groupe ADNEOM, BlackRock, BRED Banque Populaire Chappuis Halder & Co, China international capital corporation, Credit Foncier Deutsche Bank, ESTER, EY, Filament Uk, Futurescore, Grabango, Heuritech, KeyQuant, La Banque Postale, Macquarie Group, Meilleurs Agents Morgan Stanley, NetDevices etc.

# Professional seminar

- Weekly seminar (Thursday 5pm15-6pm45) from mid-september to December
- Presentation by practitioners of various banks (Fr., UK), hedge funds.
- Often former students of M2MO
- Internship offers

Attendance mandatory

# Examples of jobs for recent graduated students from M2MO

- Quantitative analyst (SoGé, Natixis, HSBC, Barclays, Nomura, Bank of America, CFM, Qube RT, ... )
- Portfolio manager (Millenium, Melanion Capital, ...)
- Risk management (JP Morgan, BNP-PAR, AXA, OSSIAM)
- Strategist (Goldman Sachs)
- Trader (Morgan Stanley, UBS)
- Consultant (Murex, Milliman, Ernst&Young, Deloitte)
- Structurer (Natixis, Exane, ...)
- Engineer for demand prediction (EDF, ENGIE)
- Data Analyst (Cubic Systemic strategies ...)
- Data Scientist (MFG Lab, Adot, Spotify, CD Discount...)
  
- PhD and career in universities or industries

## Some former graduated of M2MO (lecturer)

- I. Kharroubi (Prof. SU)
- E. Gobet, M. Rosenbaum (Prof. Polytechnique)
- S. Clemençon (Prof. Telecom Paris)
- J.D. Fermanian (Prof. Ensaé)
- C. Robert (Prof. ISFA)
- M. Hoffmann (Prof. Dauphine)
  
- B. Bruder (Amundi)
- M. Abdel-Sayed, L. Massoulard (SoGé)
- P. Gruet (EDF)

# Registration and application



For Université Paris Cité:

Open til **June 30, 2024**

**Site E-Candidat**

<https://ecandidat.app.u-paris.fr/sciences1/#!accueilView>

Answer: mid July at last

# Contact and informations

- ❑ Master website: google [M2MO](#) or <https://masterfinance.math.univ-paris-diderot.fr/>
- ❑ Email: [secretariat-m2mo@math.univ-paris-diderot.fr](mailto:secretariat-m2mo@math.univ-paris-diderot.fr)



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- Start of the Master: Monday, September 2, 2024

**QUESTIONS?**