



PRESENTATION of the MASTER 2

Random Modelling, Finance and Data

Science (M2MO)



UNIVERSITÉ de PARIS

UNIVERSITY PARIS 1 - PANTHÉON SORBONNE

2021/2022



Program Directors: J.F. Chassagneux and H. Pham (UdP)

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**

- ① **Statistics and random modelling in finance**
- ② **Statistics and Data Science**

Two courses

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)

Environment Education/Research

- **Université de Paris**



- **LPSM**: Laboratoire de Probabilités, Statistique et Modélisation, Sorbonne Université et Université de Paris, 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
- Lyxor Asset Management
- Natixis
- BNP Paribas
- Deloitte
- HSBC
- Capital Fund Management
- EDF
- Air Liquide
- RTE
- etc.



STRUCTURE OF THE ACADEMIC YEAR 2021/2022

- Starting: September 6, 2021
- Three terms with 8 weeks of lectures each
- Internship from April 11 to September 30, 2021.

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: Statistics and random modelling in finance

◉ **Core modules in term 1**

➤ **Mandatory 1: 6 ECTS**

- **Stochastic calculus and diffusion processes** - S. Péché (TD: B. Laslier)

➤ **Mandatory 2: 6 ECTS**

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

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

- **Markov chains** - M. Merle

- **Data modelling and statistical inference** – S. Delattre (TD: S. Has)

- **Introduction to Machine Learning** – S. Gaiffas et A. Fisher

- ## ◉ **Optional modules (3 ou 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, computer science.**

Course n° 1: Statistics and random modelling in finance

□ Quantitative finance:

- **Financial products** (3 ECTS) – B. Bruder (Lyxor AM)
- **Quantitative assets management** (3 ECTS) – B. Bruder (Lyxor AM)
- **Algorithmic trading** (3 ECTS) – O. Guéant
- **Stochastic control in finance** (6 ECTS) – H. Pham and S. Scotti
- **Nonlinear methods in finance** (6 ECTS) – M.C. Quenez
- **Advanced modelling in interest rate** (6 ECTS) - Z. Grbac
- **Quant analysis** (6 ECTS) – S. Crépey
- **Energy markets** (3 ECTS) – R. Aid and P. Gruet (EDF)

Course n° 1: Statistics and random modelling in finance

□ Risks in finance:

- **Risk: regulation, measure and risk management** (3 ECTS) – S. Scotti, A. El Alami (Deloitte)
- **Copulas and financial applications** (3 ECTS) – J.D. Fermanian
- **Green finance** (3 ECTS) – P. Tankov, O. Zerbib

□ Numerical and computational methods

- **Monte-Carlo methods** (6 ECTS) – N. Frikha
- **PDE in finance and numerical methods** (3 ECTS) - O. Bokanowski
- **Advanced probabilistic numerical methods in finance** (6 ECTS) – J.F. Chassagneux

Course n° 1: Statistics and random modelling in finance

□ Statistics and machine learning in finance:

- **Time series analysis** (6 ECTS) – J.M. Bardet
- **Statistics of diffusion** (6 ECTS) – A. Gloter
- **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)
- **Introduction to reinforcement learning** (3 ECTS)– J. Lussange
- **Machine learning for finance** (6 ECTS) – H. Pham

□ Computer science

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

Course n° 2: Statistics and Data Science

Mandatory modules (6 ECTS x3 = 18 ECTS)

- **Data modelling and statistical inference** – S. Delattre (TD: S. Has)
- **Introduction to Machine Learning** – S. Gaiffas and A. Fisher
- **Statistical learning** – S. Clemençon and E. Chautru

⊙ **Optional modules (3 ou 6 ECTS):**

12 ECTS must be validated in UE Data science

Course n° 2: Statistics and Data Science

- [Data Science](#) (at least 12 ECTS)
 - **Optimization for learning** (3 ECTS) – G. Garrigos
 - **Markov chains** (6 ECTS) – M. Merle
 - **Statistics of industry and data science** (3 ECTS)– M. Abdel Sayed and L. Massoulard (Société Générale)
 - **Methods for large data sets** (3 ECTS) – S. Boucheron
 - **Graphical models for machine learning** (6 ECTS) – F. Rossi
 - **Data Science projects: use cases for CRM** (3 ECTS) – K. Tribouley
 - **Introduction to reinforcement learning** (3 ECTS) – J. Lussange
 - **Deep learning** (3 ECTS) – S. Gaiffas

Course n° 2: Statistics and 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

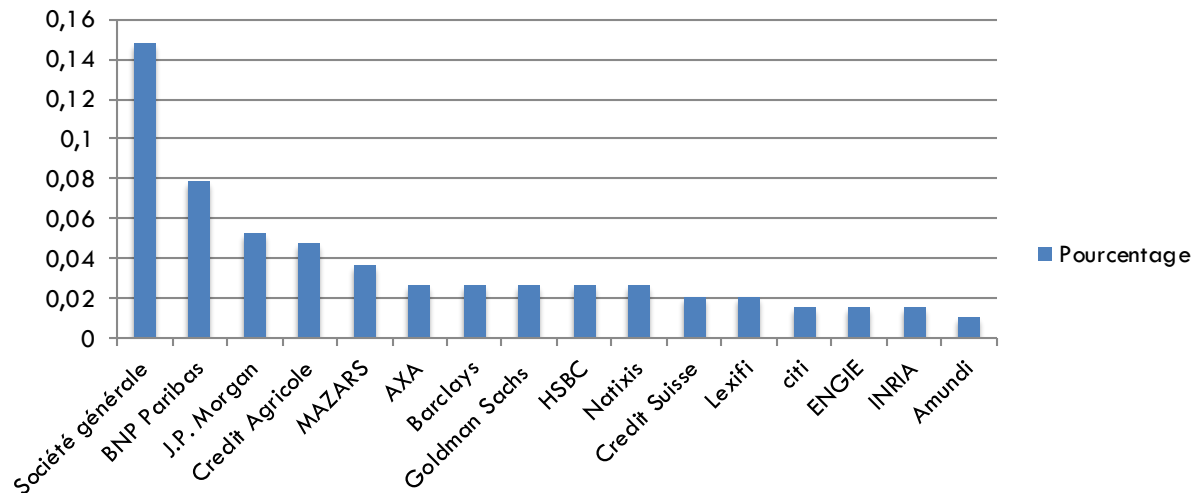
- - Internships must be validated by the pedagogical team
(check the M2MO website for details)

- - Over the years 2017-2019:
 - 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, Luxembourg, China 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 BGI 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 (on Mon. or Thurs.) from October to December
 - Presentation by practitioners of various banks (Fr., UK)
 - 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, ...)
- 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

- J.F. Chassagneux, S. Gaiffas (Prof. UdP)
- I. Kharroubi (Prof. SU)
- E. Gobet, M. Rosenbaum (Prof. Polytechnique)
- S. Clemençon (Prof. Telecom Paris)
- M. Hoffmann (Prof. Dauphine)

- B. Bruder (Lyxor)
- M. Abdel-Sayed, L. Massoulard (SoGé)
- P. Gruet (EDF)

Registration and application

- For Université de Paris:

Open from **may 10 to june 30, 2021**

Site eCandidat

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

Answer: mid july at last

- For Paris 1:

2nd session: from **june 14 to july 4, 2021**

<https://ecandidat.univ-paris1.fr/ecandidat/#!offreFormationView>

Contact and informations

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

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- Start of the Master: Monday, September 6, 2021, 9am, in-person!

QUESTIONS?