M2MO

# PRESENTATION of the MASTER 2

## Random Modelling, Finance and Data Science (M2MO)

Université Paris Cité

UNIVERSITE PARIS CITE

UNIVERSITY PARIS 1- PANTHEON SORBONNE

UNIVERSITÉ PARIS 1 PANTHÉON SORBONNE

**2022/2023**

Program Directors: J.F. Chassagneux and H. Pham (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 Statistics and random modelling in finance

② Statistics and Data Science

# Prospects

## ❑ Professionnal

- ➢ 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 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

# Industrial Partners and professional contributors

- Société Générale
- Natixis
- BNP Paribas
- CA-CIB
- Amundi
- Deloitte
- Axa
- Capital Fund Management
- EDF
- Barclays
- Morgan Stanley
- Bank of America
- Etc ...

## STRUCTURE OF THE ACADEMIC YEAR 2022/2023

- Starting: September 5, 2022
- Three terms with 8 weeks of lectures each
- Internship from April 10 to September 30, 2023.

# Curriculum

60 ECTS

15 ECTS for internship

45 ECTS on master modules

18 ECTS (3 courses) of Mandatory modules

27 ECTS in Optional modules

## ENSAE 3A and CentraleSupelec (3A, option mathematics and Data science)

- Two mandatory modules (2x6 =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 internhip 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)
  - **Mandatory 3** (except for ENSAE and CS): one course (6 ECTS) among
    - **Markov chains -** G. Giacomin
    - **Data modelling and statistical inference –** S. Delattre (TD: S. Gribkova)
    - **Introduction to Machine Learning –** 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, emerging technologies, computer science.

# Course n° 1: Statistics and 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) – H. Pham
  - **Nonlinear methods in finance** (3 ECTS) – M.C. Quenez
  - **Advanced modelling in interest rate** (6 ECTS) - Z. Grbac
  - **XVA analysis** (3 ECTS) – S. Crépey

# Course n° 1: Statistics and random modelling in finance

- ***Risks in finance:***
  - **Risk: regulation, measure and risk management** (3 ECTS) – H.Pham, B. Hassani (Quant AI Lab)
  - **Copulas and financial applications** (3 ECTS) – J.D. Fermanian

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

- ***Emerging markets and technologies***
  - **Energy markets** (3 ECTS) – P. Gruet (EDF)
  - **Green finance** (3 ECTS) – P. Tankov, T. Roncalli (Amundi)
  - **New technologies in finance** (3 ECTS) – A. Jacquier, M. Jeunesse (AXA)

# 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 in finance** (6 ECTS) – H. Pham, J.D. Fermanian

- ***Computer science***
  - **C++** (6 ECTS) - O. Carton (TD: V. Lejeune)
  - **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. Gribkova)
- **Introduction to Machine Learning –** A. Fisher
- **Statistical learning –** S. Clemençon and P. Mozharovskyi

- **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) – **G. Giacomin**
  - **Statistics of industry and data science** (3 ECTS)– M. Abdel Sayed and L. Massoulard (Société Générale)
  - **Graphical models for machine learning** (6 ECTS) – F. Rossi
  - **Data Science projects** (3 ECTS) – K. Tribouley
  - **Introduction to reinforcement learning** (3 ECTS) – J. Lussange
  - **Deep learning** (3 ECTS) – I. Giulini

# 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)

In particular, lectures in the thematic program: Geometry and Statistics in Data Science at IHP

# Internships

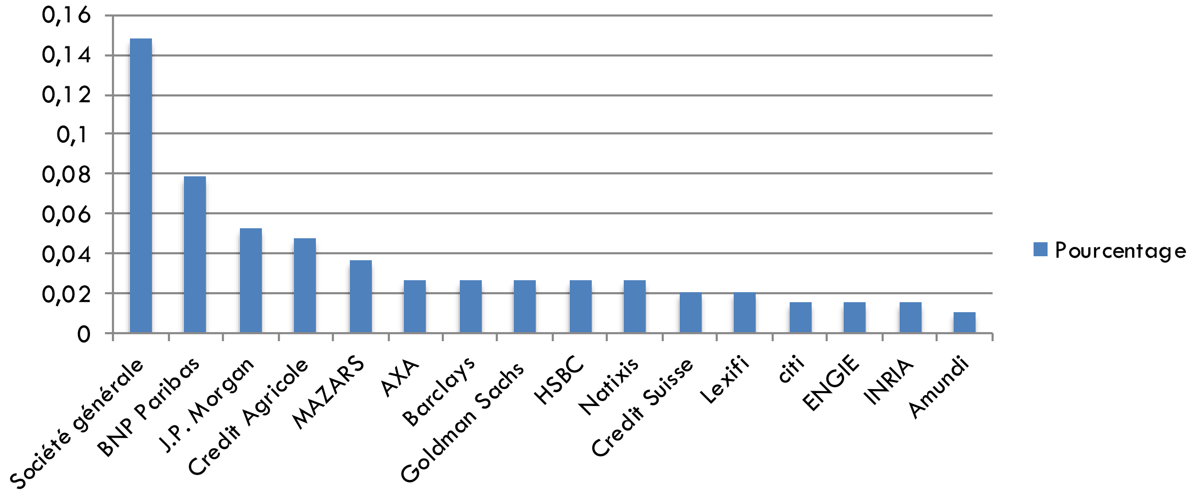
- - Internships must be validated by the pedagogical team (check the M2MO website for details)

- - 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, 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
BGFI 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 Monday) from mid-september 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, K. Tribouley (Prof. UPC)
- I. Kharroubi (Prof. SU)
- E. Gobet, M. Rosenbaum (Prof.  Polytechnique)
- S. Clemençon (Prof. Telecom Paris)
- J.D. Fermanian, C. Robert (Prof. Ensae)
- M. Hoffmann (Prof. Dauphine)

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

# Registration and application

For Université Paris Cité:

Open from may 10 to june 30, 2022

**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*

- Start of the Master: Monday, September 5, 2022

# QUESTIONS?