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

2023/2024

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, and more recently sustainable finance, emerging markets and technologies

① Statistics and random modelling in finance

② Statistics and Data Science

Prospects

- Professionnal
  - Quantitative researchers
  - 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

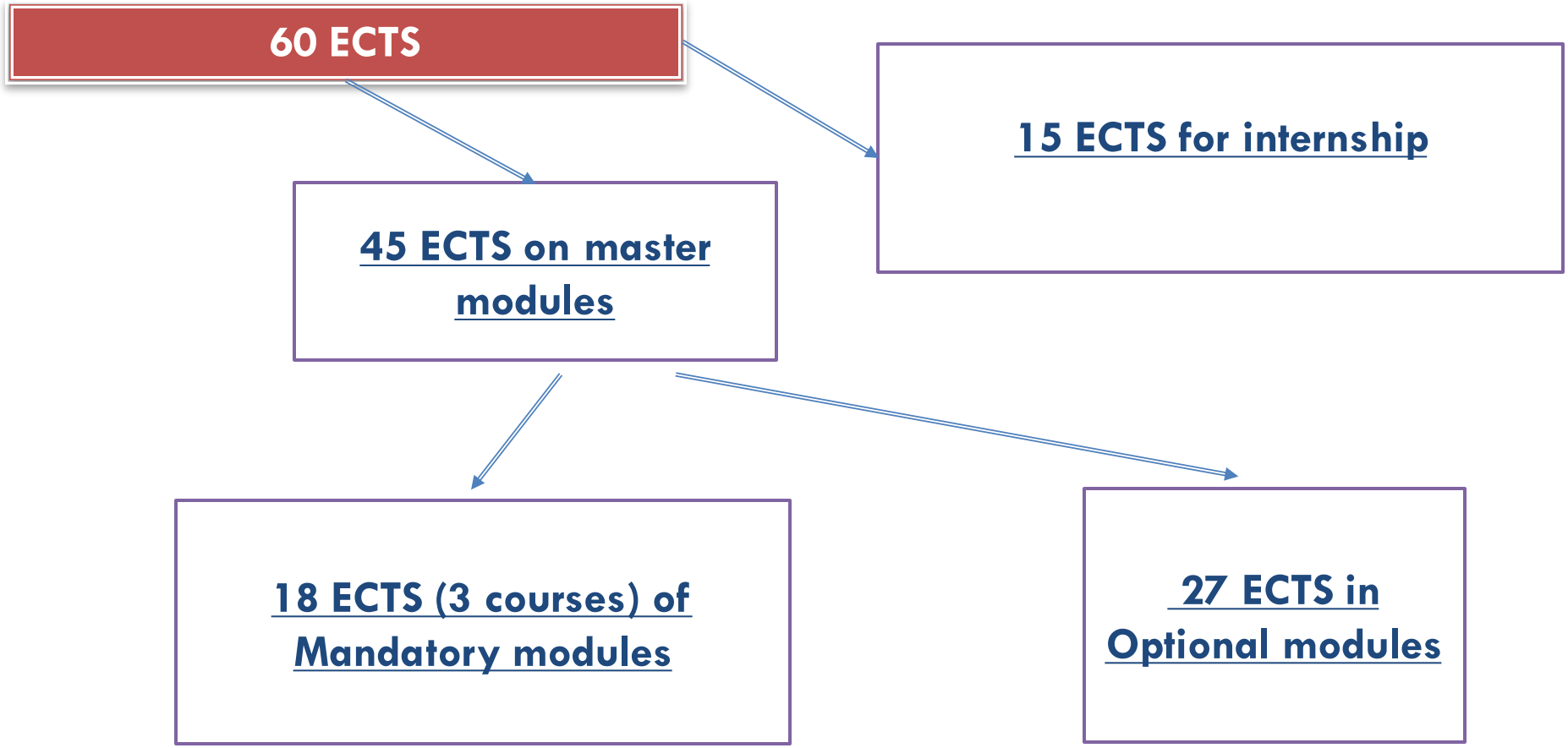
Industrial Partners and professional contributors

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

STRUCTURE OF THE ACADEMIC YEAR 20232024

- Starting: September 4, 2023
- Three terms with 8 weeks of lectures each
- Internship from April 8 to September 30, 2024.

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 -** C. Labbé (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 markets and 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
  - **Deep XVA analysis** (3 ECTS) – S. Crépey

- ***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 (Ensae)

Course n° 1: Statistics and random modelling in finance

- ***Numerical and computational methods***
  - **Monte-Carlo methods** (6 ECTS) – J.F. Chassagneux
  - **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 (Ensae), T. Roncalli (Amundi)
  - **FinTech** (3 ECTS) – L. Bertucci (ILB) , M. Jeunesse (AXA)
  - **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: Statistics and 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 (Evry)
  - **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)
  - **Advanced calibration methods and VIX derivatives** - J. Guyon (Ecole des Ponts)

(Cours de la Chaire BNP-PAR, UPC et Ecole des Ponts)

- Course from the "Statistics and data science" track

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 E. Chautru (Telecom Paris)

⊙ **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)
  - **Modern approach for dimension reduction** (6 ECTS) – A. Célisse
  - **Data Science projects** (3 ECTS) – K. Tribouley
  - **Statistics in high dimension** (3 ECTS) – B-E. Chérief-Abdellatif (CNRS, LPSM)
  - **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)

- Course from the "Statistics and finance" track
- **Produits de matrices aléatoires et systèmes désordonnnés en mécanique statistique –** G. Giacomin

Internships

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

- - Over the last years:

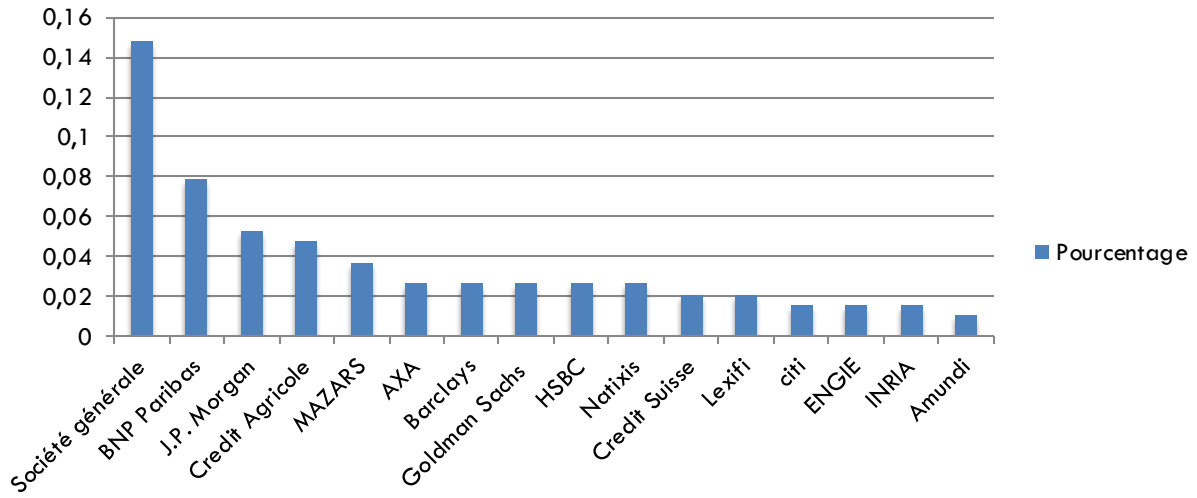
- Main topics : 20% in Data Science, 79% in Finance (1/4 data oriented) and sometimes insurance

- 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), hedge funds.
- Often former students of M2MO
- Internship offers

Attendance mandatory

Examples of jobs for recent graduated students from M2MO

- Quantitative researchers (SoGé, Natixis, HSBC, Barclays, Nomura, Bank of America, CFM, Qube RT, Jump Trading, ...)
- 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, 2023

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 4, 2023

QUESTIONS?