M2 RISQUES FINANCIERS ET FINANCE DURABLE (R2FD)
M2 FINANCIAL RISKS AND SUSTAINABLE FINANCE (R2FD)

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Cours spécifiques à l'option Magistère Economie, Data Science et Finance

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Dernière mise à jour / last update: juin 2025.

Option Pricing
Pricing d'option

COURSE LANGUAGE
English in Aix

TEACHER
Yoann BOURGEOIS – practitioner

COURSE DESCRIPTION AND OBJECTIVES
The objective of the lecture is to familiarize students with the pricing and hedging of both vanilla options and some exotic options. To do so, some mathematical fondamentals are addressed (stochastic integrals, Ito…). We present the Black Scholes framework using the replication portfolio argument and the non-arbitrage rule. Then, after a presentation of the limits of the BS framework, we introduce some stochastic volatility models and some ways to build a local volatility. We deal with parameters calibration, Monte Carlo simulations, numerical issues. Illustrations are on simulated or real data.

COURSE OUTLINE
Mathematical basics
- From discrete time to continuous time, Stochastic integrals

Black Scholes framework
- Definitions, Risk neutral measure, The replication portfolio, Hedging, Examples, Implied volatility, Call/Put parity, Monte Carlo experiments,Limits and stylized facts.

Exotic equity derivatives
- Definitions Exotic options, Alternatives to BS, SABR model, Local volatility models, Calibration, Dupire formula, Tichonov regularization

American Options
- Definitions, Regression method Longstaff-Schwartz, Example

Real options
- Definitions, Optimal investment frontier

KEY PROFESSIONAL SKILLS UPON GRADUATION
Quantitative finance, model risk, market risk.

ORGANIZATION
Semester: S1
Teaching Hours: 30 h of lectures

BIBLIOGRAPHY AND TEXTBOOKS
Brigo, D. and Mercurio, F., 'Interest Rate Models - Theory and Practice', 1998, 981p, Springer.
Cont, R., 'Frontiers in Quantitative Finance', 2008, 295p, Wiley.
Martellini, L. and Priaulet, P., 'Fixed Income Securities, Dynamic methods for interest rate risk pricing and hedging', 2001, 252p, Wiley.

RECOMMENDED PREREQUISITES
Stochastic Calculus, linear regressions, Black Scholes model, risk neutral density.

KEYWORDS
Continuous time dynamics, Wiener process, Ito's lemma, Black Scholes, calibration, hedging.

Green Bonds and Structured Products
Obligation verte et produits structurés

COURSE LANGUAGE
English in Aix

TEACHER
Xavier SAPHORE – practitioner from Crédit Agricole Corporate and Investment Bank

COURSE DESCRIPTION AND OBJECTIVES
Introduction to sustainable finance and its products, definitions and development of green and social bonds in particular, and presentation of the main products and the market for structured products.

COURSE OUTLINE
1. Financial Markets participants and introduction on bonds
   1.1. Market participants
   1.2. Introduction to bonds
2. Green Bonds and Sustainable Finance
   2.1. Definition and Purpose
   2.2. Market development
   2.3. Type and characteristics of Sustainable products
   2.4. Impact reporting
   2.5. Regulatory landscape and development
3. Structured products
   3.1. Introduction to structured products
   3.2. Historical Context and Evolutions
   3.3. Key types of Structured Products
   3.4. Market challenges

KEY PROFESSIONAL SKILLS UPON GRADUATION
Understanding the development and challenges of sustainable finance and associated financial products, as well as the players involved and market trends. Introduction to structured products, their benefits, the different products and the development of this market.

ORGANIZATION
Semester: S1
Teaching Hours: 18 h of lectures

MANDATORY PREREQUISITES
Knowledge of financial/capital markets

RECOMMENDED PREREQUISITES
Knowledge associated with sustainable finance, or an interest in social issues and ecological transition, knowledge of financial products, particularly options.

KEYWORDS
Fixed Income, Sustainable Finance, Interest Rates, Duration, portfolio construction, Investment

End-of-Studies Project in Finance
Projet de fin d'études en finance

COURSE LANGUAGE
French in Aix

TEACHER
Renaud BOURLES – renaud.bourles@centrale-med.fr

COURSE DESCRIPTION AND OBJECTIVES
In this course, a company proposes a project based on a current financial issue, which may include access to real data. Students work in groups of 4 to 5 to analyse the problem and develop a solution. The project culminates in an oral presentation delivered to the company.

COURSE OUTLINE
1. Introduction and presentation of the subject by the company
2. Group work and final oral presentation

KEY PROFESSIONAL SKILLS UPON GRADUATION
Deliver clear and professional presentations in a business context
Apply financial knowledge and analytical skills to solve real-world problems

ORGANIZATION
Semester: S1
Examination Method: Project

MANDATORY PREREQUISITES
Financial modelling, Risk measure, financial econometrics

KEYWORDS
Real-world problems, current financial issues, oral presentation

Portfolio Management and Performance
Gestion de portefeuille et mesures de performance

COURSE LANGUAGE

English in Aix

TEACHER

Georges HÜBNER – g.hubner@uliege.be

COURSE OUTLINE

Introduction: the scope of portfolio management

1. Standard Portfolio Theory, the CAPM, and asset pricing models
    a. The portfolio allocation problem
    b. The market portfolio and the Security Market Line
    c. Implementing the CAPM
    d. Multifactor models
2. Classical performance measurement
    a. Peer group comparisons
    b. The traditional performance measures
    c. The choice of a performance measure
    d. Performance measurement for multifactor models
3. Traditional and alternative portfolio management strategies
    a. Equity portfolio management
    b. Fixed income management
    c. Hedge funds and private equity
    d. ESG investments
    e. Performance measurement challenges
4. Personal portfolio management
    a. Portfolio management for the rational investor
    b. Portfolio management for the behavioral investor
    c. Performance measurement challenges
    d. Granular analysis of performance

SEARCHED SKILLS (please use bullet points)

Understand the portfolio management process and its challenges
Connect risk, return and performance of financial portfolios
Apply statistical techniques to build portfolios with desired properties
Understand the interplay between financial and nonfinancial criteria in portfolio management
Apply market-based and investor-based information in portfolio management and performance evaluation

ORGANIZATION

Semester: S1
Teaching Hours: 24 h of lectures
Comment: Including an excel-based group assignment 3h

BIBLIOGRAPHY AND TEXTBOOKS

François, P., and G. Hübner (2024), *The Complete Guide to Portfolio Performance*. Wiley

RECOMMENDED PREREQUISITES

Basic knowledge of financial economics

KEYWORDS

Asset management, Financial markets, Portfolio management, Portfolio performance

Asset Allocation and Decarbonization
Allocation d'actifs et décarbonisation

COURSE LANGUAGE

English in Aix

TEACHER

Jean-Baptiste HASSE – jean-baptiste.hasse@univ-amu.fr

COURSE DESCRIPTION AND OBJECTIVES

This course delves into the critical issue of decarbonization, exploring its definition and significance. Participants will gain a profound understanding of key concepts such as carbon footprint and portfolio temperature alignment. Through practical problem-solving exercises, the course aims to strengthen quantitative finance skills. Ultimately, the objective is to equip participants with the knowledge and tools to effectively decarbonize investment portfolios, aligning them with climate goals.

COURSE OUTLINE

Module 1: Basic principles in asset allocation
Module 2: Portfolio decarbonization I
Module 3: Portfolio decarbonization II

KEY PROFESSIONAL SKILLS UPON GRADUATION

What decarbonation is and why it is a crucial issue.
Acquire in-depth understanding of concepts like carbon footprint, portfolio temperature alignment.
Enhance your quantitative finance skills through hands-on problem solving.
Apply concepts and methods to decarbonize a portfolio.

ORGANIZATION

Semester: S1
Teaching Hours: 24 h of lectures
Comment: Each module is divided in three parts: lecture / tutorial / discussion

BIBLIOGRAPHY AND TEXTBOOKS

Andersson, M., Bolton, P., & Samama, F. (2016). Hedging climate risk. *Financial Analysts Journal*, 72(3), 13-32.
Barber, B. M., Morse, A., & Yasuda, A. (2021). Impact investing. *Journal of Financial Economics,* 139(1), 162-185.
Bolton, P., Kacperczyk, M., & Samama, F. (2022). Net-zero carbon portfolio alignment. *Financial Analysts Journal*, 78(2), 19-33.
Campbell, J. Y., & Viceira, L. M. (2002). *Strategic asset allocation: portfolio choice for long-term investors*. Clarendon Lectures in Economic.
Roncalli, T. (2024). *Handbook of sustainable finance*. Available at SSRN 4277875.
Nordhaus, W. (2019). Climate change: The ultimate challenge for economics. *The American Economic Review*, 109(6), 1991-2014.
Starks, L. T. (2023). Presidential address: Sustainable finance and esg issues—value versus values. The *Journal of Finance*, 78(4), 1837-1872

MANDATORY PREREQUISITES

A broad understanding of financial economics concepts.
An in-depth understanding of principles related to asset management.
A robust background in portfolio optimization / financial econometrics.
A good knowledge of MS Excel and the Solver.

RECOMMENDED PREREQUISITES

Notions in optimisation

KEYWORDS

Asset allocation, Decarbonization, Climate change, Sustainable finance

Market Risk Models
Modèles de risque de marché

COURSE LANGUAGE

English in Aix

TEACHER

Mathias SCHMIT – practitioner

COURSE DESCRIPTION AND OBJECTIVES

The aim of the course will help students to understand the various banking activities and financial statement structures, way banks function and are able to generate value, financial risks faced by banks and their measurement, banking regulation and risk management in light of the recent crisis, current regulatory challenges and the impact on the banking business conduct and managing risk in portfolio Management.

COURSE OUTLINE

a. **UNDERSTANDING BANKING FINANCIAL STATEMENT STRUCTURE**
MANDATORY: BEFORE THE SESSION PREPARE THE BANKING DETECTIVE CASE.
- Understanding a financial institution business model
  - Understanding the funding of a bank (equity, debt, wholesale funding, deposits, repo...)
  - Understanding the revenue producing activities of a bank (consumer loans, mortgage loans, long term investment, securitization, banking and trading books, asset financing, etc…)
  - Understanding the differences between the different types of financial institutions (retail bank, saving and postal banks, investment bank, hedge fund, UCITS funds, insurance, microfinance institutions, consumer credit institution etc…)
  - Understanding the financial risks faced by a financial institution

b. **UNDERSTANDING FINANCIAL RISKS IN BANKING**
- Definition of risk
  - What are the different types of risks?
  - What is the importance of theses risk for a bank?
- Measurement of risk
  - What are the different measures of risk?
  - What do they really measure (uses and pitfalls)
  - What is normal? What is extreme?
- Risk management
  - What is risk management about?
  - What does it imply in terms of organization and performance?
  - What are the uses and pitfalls of Basel Accords?
  - What is (and is not) the role of regulatory/economic capital?
  - What are the uses and pitfalls of Basel Accords?
- What are the impacts of Basel II/III/IV on business conducts for financial institutions?
- What are the key challenges of Basel II/III/IV for a fast growing financial institution?
  - What are the uses and pitfalls of Basel Accords?
- Event vs. Cause-effect approach when managing risks
- Lessons learnt from case studies

Cases: ING Direct, SVB Bank, Signature Bank, Kaupthing Bank

c. **KEY TOPICS IN ASSET MANAGEMENT AND EU FUND INDUSTRY**
- Organization of financial markets
- Fund market: key figures, fund types
- Market volatility, systematic risk-expected return relationship
  - What is normal? What is extreme?
- Regulatory, legal and administrative provisions in the fund industry (MIFID, UCITS, AIFMD)
- From market activities to post-market activities: the various players and their added values

Cases: Madoff, LuxAlpha

KEY PROFESSIONAL SKILLS UPON GRADUATION

At the end of the course and after studying the course, students should be able to analyse from a high-level perspective the performance and the risks of a financial institution based on its business model. The course will be taught in such a way that key messages can be transposed to other industries (e.g. performance assessment, risk management governance, bird's eye view of the main aspects of risk management, etc.). The course will complement and apply concepts taught in accounting, corporate finance, and financial analysis.

ORGANIZATION

Semester: S1

Teaching Hours: 18 h of lectures, in 4 sessions

Comment: The course is based on the uses of a variety of pedagogic and interactive methods, including case studies from the industry, shared experience, analyses of current examples and best practices. Active involvement and contribution from the participants are highly recommended and welcomed. Also, case preparations are mandatory before the course.

Examination Method: For each session, describe two key learning outcomes (each learning outcome should be described in 5 to 10 lines) in a structured document in such a way any reader can understand the red thread of your document. The document should also contain a table of content, general introduction, conclusion and references. So, the document should contain in total 8 learning outcomes.

Amongst you learning outcomes, you should select one of them and illustrate it based on readings/videos you choose and a case study. A document of 6 pages maximum should be provided. Ideally, the work can be distributed to your classmates as potential readings after the course for their own interests.

BIBLIOGRAPHY AND TEXTBOOKS

Basel Committee on Banking Supervision (2005), *"An explanatory note on the Basel II IRB risk weight functions",* BIS, July. http://www.bis.org/bcbs/irbriskweight.htm

Curtis P. and Carey M. (2012), *"Risk assessment in practice"*, COSO, 28 pages.

Dowd K., Cotter J., Humphrey C. and Woods M. (2008), *"How unlucky is 25-Sigma?"*, 7 pages. Read pages 1 to 4.

Jorion P. (2000), *"Risk Management Lessons from LTCM"*, European Financial Management, Vol. 6, N° 3, pp. 277-300

Schmit M. (2013), *"New Requirements and Changes of Basel III: Towards a New Business Model for Financial Institutions ? "*, 20 pages.

Taleb N., Goldstein D. and Spitznagel (2009), *"The six mistakes executives make in risk management"*, Havard Business Review, 5 pages.

Taleb N., (2007), "The black swan", Get abstracts compressed knowledge, 5 pages.

Vermaelen T. (2011), *"CEOs should refresh their finance skills"*, QFINANCE, 4 pages.

KEYWORDS

Credit risk, market risk, liquidity risk, value management, impact of Basel framework on banking business conduct

Credit Risk Models
Modèles de risque de crédit

COURSE LANGUAGE

English in Aix

TEACHER

Practitioners from Deloitte

COURSE DESCRIPTION AND OBJECTIVES

The aim of this course is to understand how credit risk is modeled, measured and regulated in the financial sector.

COURSE OUTLINE

The first 12 hours are devoted to lectures with the following outline:

1. Introduction to credit risk
2. Scoring models and probability of default
3. LGD and CCF models
4. Margin of Conservatism
5. Application

The last 12 hours are devoted to the running of the DRiM (Data for Risk Management) inter-University Challenge (presentation of the subject, off-class and in-class work and final presentation by the students).

KEY PROFESSIONAL SKILLS UPON GRADUATION

Understand how credit risk is modelled, measured and regulation
Know how to build and estimate a credit risk model

ORGANIZATION

Semester: S1
Teaching Hours: 24 h of lectures
Comment: 4 lectures of 3 hours each and a 12-hour project

Financial Econometrics
Econométrie de la finance

COURSE LANGUAGE

English in Aix

TEACHER

Sullivan HUE – sullivan.hue@univ-amu.fr

COURSE DESCRIPTION AND OBJECTIVES

The goal of the course is to study the main econometric models and techniques allowing to analyse financial time series. The end of the course is devoted to the analysis of market risk.

COURSE OUTLINE

1) Describing Financial Data
2) Univariate Time Series Analysis
3) Volatility Modeling : Conditional Heteroscedastic Models
4) Market risk measures : VaR and ES
5) Backtesting market risk measure

KEY PROFESSIONAL SKILLS UPON GRADUATION

To understand stylized facts of financial data
To know how to take into account these stylized facts with statistical models
To understand the advantages and limits of ARMA and ARCH/GARCH models
To understand how to measure market risk

ORGANIZATION

Semester: S1
Teaching Hours: 18 h of lectures, in 6 sessions of 3 hours each
Comment: For each chapter, 60% of the course is devoted to a theoretical presentation and 40% of the course is devoted to an empirical application.

BIBLIOGRAPHY AND TEXTBOOKS

Brooks C. (2008) Introductory Econometrics for Finance, 2nd Edition, Cambridge University Press
J. Danielsson (2011) Financial Risk Forecasting, Wiley
Backtesting, P. Christoffersen (2008)

MANDATORY PREREQUISITES

Econometrics
Time-Series analysis (ARMA models)
R
Python

KEYWORDS

Stylized facts, ARMA, ARCH, GARCH, VaR, ES, backtesting

Risk and Compliance
Risque et conformité

COURSE LANGUAGE

English in Aix

TEACHER

Thibault GODBILLON – practitioner from ESMA (European Securities and Markets Authority)

COURSE DESCRIPTION AND OBJECTIVES

Banks, and the financial sector more broadly, operate in a highly regulated environment. Financial regulations evolve over time, in response to key events, such as the 2008 Global Financial Crisis, emerging risks (e.g., data, cyber security, FinTech, etc) the COVID19 pandemic, or the failure of SVB and Credit Suisse. They have broadened to encompass all parts of the financial system: banks and non-banks — insurers, market infrastructures, credit rating agencies, hedge funds, etc.

Global policymakers (including BCBS, FSB, IOSCO) have developed international standards to support the G20 mandates — ensuring the stability and resiliency of the global financial system.

At the local and regional level (in the EU for instance), prudential and market regulators are tasked with transposing these global standards in their own framework, which may cause some variations in the way regulations are implemented across jurisdictions.

This lecture aims to provide students with an understanding of the global regulatory architecture, ensure they understand where regulations come from, and how to stay up-to-date with a complex and constantly evolving topic. The course will also provide students with an overview of the current rules and regulations applying to banks and financial market operators in general.

Via the drafting of a two-page note on a specific topic from the course, students will practice their written English communication and capacity to summarise complex matters.

Finally, via the participation of experts from various background, the course will provide students with an insight into working for global organisations.

COURSE OUTLINE

1) An introduction to financial regulations
2) Prudential regulations (Basel standards, CRD/CRR, DFA)
3) Crisis management (FSB standards, BRRD/CMDI, DFA)
4) Overview of Market regulations (International standards, MIFID/EMIR)
5) Sustainable Finance (Key risks, FSB/BCBS standards, EU taxonomy/GBS/ SFDR)
6) Digital Finance (Key risks, FSB/BCBS standards, DORA/MiCAR)

KEY PROFESSIONAL SKILLS UPON GRADUATION

Capacity to stay up to date on the evolution of international financial regulation

ORGANIZATION

Semester: S1

Teaching Hours: 18 h of lectures, in 6 sessions of 3 hours each

BIBLIOGRAPHY AND TEXTBOOKS

Provided in lectures.

MANDATORY PREREQUISITES

English spoken and written

RECOMMENDED PREREQUISITES

Good understanding of functioning of financial markets

Good understanding of financial institutions' balance sheet (banks in particular)

KEYWORDS

International financial regulation, banking regulation, derivatives regulation, FSB, G20 CRR,CRD, MICARD, DORA, MIFID, EMID BRRD, BCBS

Bond Management and Interest Rate Risk
Gestion obligataire et risque de taux

COURSE LANGUAGE

English in Aix

TEACHER

Mathieu CRANZ – practitioner from AXA

COURSE DESCRIPTION AND OBJECTIVES

Introduction to the bond market, definition of interest rate risk, analysis of the relationship between interest rates and bond prices, and presentation of the fundamentals of bond management (construction and management of a bond portfolio).

COURSE OUTLINE

1. Introduction
2. Bond Markets Overview
3. Primary & Secondary Market
4. Bond Prices and Yields (Price yield relationship)
5. Bond Price Sensitives
6. Instrument to manage interest risk
7. Measures and hedging of the Interest rate risk

KEY PROFESSIONAL SKILLS UPON GRADUATION

Understanding how the bond market works (primary and secondary markets), the relationship between interest rates and bond prices, and the main indicators for measuring the sensitivity of bonds to changes in interest rates. Introduction to the principles of bond management and the construction of portfolios adapted to different investor profiles.

ORGANIZATION

Semester: S1
Teaching Hours: 18 h of lectures

MANDATORY PREREQUISITES

Knowledge of financial/capital markets

RECOMMENDED PREREQUISITES

Principle of discounting/Present Value, internal rate of return

KEYWORDS

Fixed Income, Interest Rates, Duration, portfolio construction, Investment,

Climate Risk Management
Gestion du risque climatique

COURSE LANGUAGE

English in Aix

TEACHER

William AUVRAY – practitioner from EY

COURSE DESCRIPTION AND OBJECTIVES

The objective of the course "Climate Risk Management" is to demonstrate how climate risks can be integrated into the management, risk, and valuation models of a Corporate and Investment Bank (CIB) and a retail bank. First, we will redefine the concepts of "risk," climate risks, financial risks, and the double materiality of climate risks. Academic and industrial examples will be presented throughout the course.

COURSE OUTLINE

I. Introduction to Climate & Environmental risks, financial risks and "Double materiality"
   a. Introduction to Climate & Environmental risks
   b. Introduction to financial risks
   c. Introduction to double materiality
II. Adaptation: Transmission channels of climate risks in retail and CIB
III. Mitigation: Mitigating Climate risks with carbon accounting
IV. Regulatory Landscape for Sustainable Finance in Europe
V. Integration of climate risks in a market risk model
VI. Integration of climate risks in a credit risk model

KEY PROFESSIONAL SKILLS UPON GRADUATION

Define climate risks and explain how they can impact investment and retail banking
Understand the obligations of banks concerning climate risks
Propose methodologies for the integration and modeling of climate risks.

ORGANIZATION

Semester: S1
Teaching Hours: 18 h of lectures

BIBLIOGRAPHY AND TEXTBOOKS

Basel Committee analytical report on climate-related risk drivers and their transmission channels, April 2021
https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.202011finalguideonclimate-relatedandenvironmentalrisks~58213f6564.fr.pdf
https://carbonaccountingfinancials.com/en/standard#a
Climate Change Valuation Adjustment (CCVA) Using Parameterized Climate Change Impacts, Chris Kenyon, Mourad Berrahoui, 2021
CO2eVA: Pricing the transition of carbon externalities, Chris Kenyon, Andrea Macrina, Mourad Berrahoui, 2022
Climate Scenario Analysis in the Trading Book, ISDA, 2023-2024
XVA: Credit, Funding and Capital Valuation Adjustments, Andrew Green, 2015
https://climate-impact-explorer.climateanalytics.org/
www.unepfi.org
Vasicek, «Probability of loss on loan portfolio,» John Wiley & Sons, 1987.
«2022 climate stress test,» European Central Bank, July 2022

MANDATORY PREREQUISITES

Completed L3 level mathematics courses
Familiarity with basic concepts of Market Finance (Valuation, Replication, Hedging, etc.)

KEYWORDS

Modeling, Physical Risks, Transition Risks, Transmission Chains, Counterparty Risk, XVA, Double Materiality, Credit Risk, Probability of Default

Financial & Extra-Financial Analysis
Analyse financière et extra-financière

COURSE LANGUAGE

English in Aix

TEACHER

Marie WEYDERT – practitioner from Crédit Agricole Alpes Provence

COURSE OUTLINE

- Real Estate Investing
  - Qualitative and quantitative data
  - Profitability measurements
  - Property valuation
- Real Estate Financing
  - Professional Investor's Business Plan
  - Bank Financing
  - Crowdfunding Financing
- Extra-Financial Performance
  - Sustainable Development & International Consensus *(SDG, Paris agreement on global warming)*
  - Major Risks for Finance Actors *(physical, transition, reputation; application to RE)*
  - European Regulation *(green deal, taxonomy, CSRD)*
  - Sustainable Finance *(ESG, CSR, finance actors' responsibility, investment decisions, trajectory, greenwashing)*
  - Extra-Financial Report *(materiality matrix, KPIs, audit, data)*
- Risk analysis in Banking Internal Control *(Risk-Based Approach, Operational Risk, KYC…)*

KEY PROFESSIONAL SKILLS UPON GRADUATION

Understand the concepts of Real Estate Investment Analysis – investor's viewpoint
Understand the concepts of Real Estate Financing – financer's viewpoint
Know the regulation on Extra-Financial performance and its impact on finance actors

ORGANIZATION

Semester: S1
Teaching Hours: 18 h of lectures
Comment: Handouts are provided at the end of each lecture.
Examination Method: In-class participation + Team presentations + Final exam

MANDATORY PREREQUISITES

Financial statements reading
Basic skills in excel

KEYWORDS

Real Estate, Extra-Financial

Structured Finance
Financement structuré

COURSE LANGUAGE

English in Aix

TEACHER

Antonin REYNAUD – practitioner

COURSE DESCRIPTION AND OBJECTIVES

The course aims to present the key analyses conducted during an M&A process and to introduce all the stakeholders involved.

COURSE OUTLINE

1. Strategy & Transactions
2. The Transaction environment
3. Illustrative Deal Process
4. An Illustration of a valuation
5. Valuation methods
6. Advance Excel
7. Useful KPIs
8. Go further
9. Appendices

KEY PROFESSIONAL SKILLS UPON GRADUATION

Accounting skills
Advanced Excel
Valuation methodology

ORGANIZATION

Semester: S1
Teaching Hours: 18 h of lectures

RECOMMENDED PREREQUISITES

Basics Excel knowledge
Basics accounting knowledge

KEYWORDS

Corporate Finance, Transaction Services, M&A, Excel, Valuation methodology

Sustainable Finance
Finance durable

COURSE LANGUAGE

English in Aix

TEACHER

Pauline BARTHOULOX – practitioner
Léo FARGEAS – practitioner from WeeFin

COURSE DESCRIPTION AND OBJECTIVES

This course aims to provide students with an in-depth understanding of the issues and practices of sustainable finance. It explores how financial institutions integrate ESG and impact criteria into their investment decisions, the growing role of national and European regulation, and the challenges of greenwashing. Students will also learn how to quantify sustainability using tools and metrics such as ESG scores and portfolio temperatures. Particular attention will be paid to practical cases and current debates, linking theory and practical application.

COURSE OUTLINE

Introduction to sustainable finance
- Definition and importance of sustainable finance.
- Historical development and current context.
- Key concepts: ESG, responsible investment and impact finance.

Current financial context, regulation and risks of greenwashing
- Analysis of sustainable finance regulations (SFDR, European Taxonomy, etc.).
- Understanding and detecting greenwashing.
- Case studies and debates on recent controversies.

Quantifying sustainability
- Understanding ESG scores: construction and limitations.
- Measuring the 'temperature' of financial portfolios.
- Innovative methodologies and tools.

Case studies and student presentations
- Critical analysis of sustainable funds.
- Solving concrete problems in teams.
- Presentation of student work.

KEY PROFESSIONAL SKILLS UPON GRADUATION

Understand the fundamental concepts of sustainable finance and their recent evolution.
Identify and analyse tools for assessing ESG performance.
Develop the skills to analyse real cases of sustainable fund management and assess the risks of greenwashing.
Master the fundamentals of sustainable finance and associated regulations.
Know how to analyse ESG data, its sources and its relevance to decision-making.
Assess sustainable asset management practices and detect the risks of greenwashing.
Develop communication skills, particularly for professional presentations.

ORGANIZATION

Semester: S1
Teaching Hours: 24 h of lectures
Comment: Lectures, case studies, group work and interactive presentations.

BIBLIOGRAPHY AND TEXTBOOKS

Eurosif - Overview of disclosure requirements *https://www.eurosif.org/wp-content/uploads/2021/12/Eurosif-Infographic-Misalignment-in-application-of-Sustainable-Finance-requirements.pdf*
Groupama – Guide pédagogique de la Finance Durable : https://www.groupama-am.com/wp-con tent/uploads/2022/02/Guide-la-finance-durable-Groupama-AM_Edition-2022.pdf
AMF – Doctrine 2020-03 : informations a fournir par les placements collectifs intégrant des approches extra-financières : https://www.amf-france.org/sites/default/files/doctrine/Position/Informations%20a%20fournir%20par%20les%20placements%20collectifs%20integrant%20des%20approches%20extra-financieres.pdf
Label ISR – Liste des fonds labellisés : https://www.lelabelisr.fr/comment-investir/fonds-labellises/?_parent_type=autre

UN-PRI - AN INTRODUCTION TO RESPONSIBLE INVESTMENT https://www.unpri.org/an-introduction-to-responsible-investment/an-introduction-to-responsible-investment-screening/5834.article
WeeFin - Benchmark des fournisseurs de données ESG : https://weefin.co/2020/04/0 6/fournisseur-de-donnees-esg-faire-le-bon-choix/
ILB – The Alignment Cookbook : https://gsf.institutlouisbachelier.org/publication/the-alignment-cookbook-a-technical-review-of-methodologies-assessing-a-portfolios-alignment-with-low-carbon-trajectories-or-temperature-goal/
Finance 4 Tomorrow – Finance & Biodiversité : l'écosystème français : https://financefortomorrow.com/app/uploads/2022/03/F4T-Finance-Biodiversite-lEcosysteme-francais.pdf

MANDATORY PREREQUISITES

Basic knowledge of finance and risk management.
Knowledge of statistical and quantitative analysis tools.

RECOMMENDED PREREQUISITES

Familiarity with responsible investment concepts.
Basic knowledge of environmental economics.

KEYWORDS

Sustainable finance, ESG, responsible investment, greenwashing, financial regulation, sustainable portfolio, SFDR, European Taxonomy, green finance, portfolio temperature, ESG scoring.

Research Methodology
Méthodologie de la recherche

COURSE LANGUAGE

English in Aix

TEACHER

Marcel ALOY – marcel.aloy@univ-amu.fr

COURSE DESCRIPTION AND OBJECTIVES

This course provides support for students who have to prepare a Master's thesis during the year. After clarifying what is expected in a research dissertation, students must present the state of progress of their work.

COURSE OUTLINE

During the first session, the steps to write a Master Thesis are presented and explained
During the subsequent course sessions, each student have to present his/her own work and make a discussion about a topic.

KEY PROFESSIONAL SKILLS UPON GRADUATION

To be able to develop a research argumentation/reasoning and write a research or internship thesis (Master 2).

ORGANIZATION

Semester: S2
Teaching Hours: 18 h of lectures
Comment: After a reminder of the prerequisites for a research dissertation, each student will be asked to present his or her research project and the state of progress of his or her work.

MANDATORY PREREQUISITES

Students must have contacted their dissertation supervisor to specify their research topic.

Professionalisation Workshops
Ateliers de professionnalisation

COURSE LANGUAGE

English

COURSE DESCRIPTION AND OBJECTIVES

This workshop is designed to guide students in their transition from academic training to the job market. **Participation in all activities is mandatory.**

It combines several complementary components:

- **Afterworks** (on campus or online), where companies and institutions introduce themselves to students, share insights into their missions, and discuss opportunities for collaboration.
- A **Career Day**, organized in two parts: first, recent graduates present their career paths, current positions, and how their training helped them enter the job market; second, a large recruitment fair brings together around 50 local, national, and international companies and institutions to offer internships and job opportunities.
- A course entitled *"Building a Strong Application"*, providing practical tools and strategies for professional integration.
  It is divided into three parts:
  - First part (lecture): Preparing for interviews (best practices, preparation methods, and self-presentation); searching for an internship or a job abroad (application strategies, networks, and resources); negotiating salaries (key principles for successful negotiation).
  - Second part (workshops): Small-group sessions offered to M2 students, focusing on CV writing and mock interview practice.
  - **Third part (AMF):** Students will be supported for preparing the AMF (French Financial Market Authority) certification through lectures and on-line preparation.

Together, these activities give students concrete experience, direct contact with employers, and essential skills to confidently approach their future careers.

KEY PROFESSIONAL SKILLS UPON GRADUATION

By the end of the workshop, students will possess the essential skills to approach the job market with confidence. They will know how to present themselves effectively, understand recruiters' expectations in France and abroad, and activate a professional network. Through lectures and practical workshops, they will be able to prepare strong applications, succeed in interviews, and conduct salary negotiations with assurance. They will lastly be able to pass a certification allowing to work within the French financial market.

ORGANIZATION

Semester: S1
Teaching Hours: 10 h of tutorials
Comment: Students will do the AMF certification.

Financial Optimisation Methods (non MAG)
Méthodes d'optimisation en finance (non MAG)

COURSE LANGUAGE

English in Aix

TEACHER

Yoann BOURGEOIS – practitioner

COURSE DESCRIPTION AND OBJECTIVES

This lecture aims at preparing students to be confident both in theory and implementation of diverse optimization methods used in quantitative finance positions (asset management, model validation, compliance FO, structuration, risk department, trading…) We point out some ways to choose the best method adapted to a specific problem and environment (admissible computation time, systems, real time needs…). Theoretical basics and accurate knowledge are very important to make that choice. So, we insist, among others, on the decomposition of the Mean Squared Error, some Newton and quasi-Newton based algorithms, the regularization methods, the Cauchy point definition for constraint problems, the stochastic algorithms.
We present several use cases in R. Computer needed during the lecture for the implementations.

COURSE OUTLINE

Some miscellaneous statistical and mathematical notions
- Near singular covariance matrix
- Convexity
- Finite difference method
- Parametric model
- Ill posed problem
- Bias/variance dilemma and MSE
- Methods to control the MSE variance

Steepest Gradient Descent

Newton and Quasi Newton methods
- Local convergence of Newton's method
- Quasi-Newton methods
  - BFGS, Convergence results of BFGS, L-BFGS, L-BFGS-B
- Use case: Heston model calibration

Dichotomic research
- Use case: implied volatility

Stochastic algorithms
- Simulated Annealing, Genetic algorithm, ADAM
- Use case: ADAM for non-linear boundary classifier

KEY PROFESSIONAL SKILLS UPON GRADUATION

Quantitative finance, model risk, market risk.

ORGANIZATION

Semester: S2
Teaching Hours: 18 h of lectures
Comment: For non-MAG students.

BIBLIOGRAPHY AND TEXTBOOKS

Nocedal, J. and Wright, S.J., 2006, 'Numerical Optimization', 684p, Springer.
Lorenzo Bergomi, 2016, 'Stochastic Volatility Modeling', 522p, Chapman & Hal Press.

RECOMMENDED PREREQUISITES

Be familiar fixed point, gradient, hessian, MSE & EMSE.

KEYWORDS

Estimation, calibration, linear problems, optimization with bounds and linear constraints, large parameters set.

Computational Finance and Asset Management (non MAG)
Finance computationnelle et gestion d'actifs (non MAG)

COURSE LANGUAGE
English in Aix

TEACHER
Jean-Baptiste HASSE – jean-baptiste.hasse@univ-amu.fr

COURSE DESCRIPTION AND OBJECTIVES
This course provides a rigorous foundation in algorithmic thinking and problem-solving techniques essential for success in quantitative finance. You will delve into core concepts like algorithms, data structures, and programming languages, with a focus on R. Through hands-on exercises and a capstone project, you will apply your knowledge to solve real-world challenges faced by asset managers. By the end of this course, you will have enhanced your quantitative finance skills and gained practical experience in tackling industry-relevant problems.

COURSE OUTLINE
Module 1: Basic principles in algorithmics
Module 2: Portfolio optimization
Module 3: Performance measurement
Module 4: Sustainable investing
Module 5: ESG scoring

KEY PROFESSIONAL SKILLS UPON GRADUATION
How to think algorithmically and solve programming problems efficiently.
Acquire in-depth understanding of concepts like algorithms, data structures, and familiarity with a number of languages, including R.
Enhance your quantitative finance skills through hands-on problem solving.
Apply concepts and methods learned during your Master to solve a typical problem in the asset management industry.

ORGANIZATION
Semester: S2
Teaching Hours: 12 h of lectures
Comment: For non-MAG students. Each module is divided in three parts: lecture / tutorial / discussion

BIBLIOGRAPHY AND TEXTBOOKS
Campbell, J. Y., & Viceira, L. M. (2002). Strategic asset allocation: portfolio choice for long-term investors. Clarendon Lectures in Economic.
Cochrane, J. (2009). Asset pricing: Revised edition. Princeton University Press.
Ihaka, R., & Gentleman, R. (1996). R: a language for data analysis and graphics. Journal of Computational and Graphical Statistics, 5(3), 299-314.
Matloff, N. (2011). The art of R programming: A tour of statistical software design. No Starch Press.
Roncalli, T. (2024). Handbook of sustainable finance. Available at SSRN 4277875.
Venables, W. N., Smith, D. M., & R Development Core Team. (2004). An introduction to R.
Würtz, Diethelm, et al. Basic R for finance. Finance Online Publishing, 2010.

MANDATORY PREREQUISITES
A broad understanding of financial economics concepts.
An in-depth understanding of principles related to asset management.
A robust background in financial econometrics.
A good knowledge in financial softwares and some programming skills.
A How to think algorithmically and solve programming problems efficiently.

KEYWORDS
Computational Finance, Asset allocation, Performance measurement, Sustainable finance

Big Data Tools (MAG)
Outils des Big Data (MAG)

COURSE LANGUAGE

English in Marseille

TEACHER

Hervé MIGNOT – practitioner from Equancy

COURSE OUTLINE

1. Hadoop. HDFS. MapReduce. Stockage et calculs distribués. Déploiement d'un cluster.
2. Préparation, stockage et traitement des big data : Pandas, Hive and Pig
3. Data visualisation avec matplotlib & seaborn
4. Alternatives : solutions propriétaires, bases NoSQL, ElasticSearch

ORGANIZATION

Semester: S1
Teaching Hours: 24 h of lectures
Comment: Class exclusive for Magistere students.

Machine Learning and New Data (MAG)
Machine learning et nouvelles données (MAG)

COURSE LANGUAGE

English in Marseille

TEACHER

Quentin LIPPMANN – quentin.lippmann@univ-amu.fr

COURSE DESCRIPTION AND OBJECTIVES

This course proposes to study the processing and analysis of unstructured data, and more specifically textual data and images.

COURSE OUTLINE

This course is divided in two parts of 12 hours each. The first part covers text as data. The second is about image as data.

Part 1 – Text as Data

Block 1 – Foundations of NLP

Students will learn about the complete document-pre-processing pipeline, beginning with tokenisation and the construction of n-grams. They will create Bag-of-Words representations and apply TF–IDF weighting to highlight discriminative terms. We will then move to distributed word representations through word embeddings, extract entities with Named-Entity Recognition, and analyse sentence structure by performing dependency parsing.

Block 2 – Large Language Models

Students will learn about the transformer architecture and its self-attention mechanism, compare pre-training with fine-tuning, and experiment with in-context learning. They will study Reinforcement Learning from Human Feedback as an alignment method and practice prompt-engineering patterns to steer model behaviour. We will tackle hallucination and explore retrieval-augmented generation as a mitigation strategy.

Part 2 – Image as Data

Block 1 – Image Fundamentals

Students will learn about digital image representation and colour spaces, then examine convolution operations—kernel size, stride, padding—and their effect on the receptive field. They will study activation and pooling layers for feature extraction and understand bounding-box regression. Anchor-based and anchor-free object-detection strategies will be compared.

Block 2 – Facial Analysis, Segmentation & Generative AI

Students will learn about classical Haar cascades versus modern RetinaFace detectors for face localisation. They will map facial landmarks, build embedding-based recognition pipelines, and evaluate systems using FAR, FRR, ROC curves, and demographic-bias checks. Promptable segmentation models will be introduced, followed by diffusion-based generative models for image synthesis.

All the concepts are applied and illustrated in Python applications.

KEY PROFESSIONAL SKILLS UPON GRADUATION

To learn how to process and analyse textual data
To learn how to process and analyse images

ORGANIZATION

Semester: S1
Teaching Hours: 24 h of lectures
Comment: Class exclusive for Magistere students.

End-of-Studies Project (MAG)
Projet de fin d'études (MAG)

COURSE LANGUAGE

French in Marseille

TEACHER

A teacher + a practitioner

COURSE DESCRIPTION AND OBJECTIVES

The end-of-studies project is carried out in collaboration with a company from October to March. This project enables students to carry out operational engineering work in data science and to compare theory with applications in the professional world.

KEY PROFESSIONAL SKILLS UPON GRADUATION

To be able to tackle a data science problem and write a report to answer it.
To know how to work as a team and to meet a set of specifications.

ORGANIZATION

Semester: S1
Comment: Class exclusive for Magistere students. Bimonthly meetings with supervisors, and autonomous work between meetings.
Examination Method: Project + Defense

Topics in Data Science (MAG)
Sujets en Data Science (MAG)

COURSE LANGUAGE

English in Marseille

TEACHER

Pierre MICHEL – pierre.michel@univ-amu.fr
Christophe HURLIN – practitioner

COURSE DESCRIPTION AND OBJECTIVES

This course aims to raise students' awareness of topical issues in data science.

COURSE OUTLINE

1. Conformal prediction
   a. Introduction and theoretical foundations
   b. Conformal prediction for regression
   c. Conformal prediction for classification
2. Algorithmic fairness
   a. Introduction to algorithmic fairness
   b. Framework for fairness in machine learning
   c. Measuring algorithmic fairness
   d. Testing for algorithmic fairness
   e. Mitigating algorithmic biases

KEY PROFESSIONAL SKILLS UPON GRADUATION

Understand how to make conformal prediction for regression and classification
Understand algorithmic fairness, and how to measure it, test it and mitigate its biases.

ORGANIZATION

Semester: S2
Teaching Hours: 24 h of lectures
Comment: Class exclusive for Magistere students.

Cours spécifique Magistère
Dernière mise à jour / last update: juin 2025.

Projects in Data Science (MAG)
Projets en Data Science (MAG)

COURSE LANGUAGE
English in Marseille

TEACHER
Pierre MICHEL – pierre.michel@univ-amu.fr
Christophe HURLIN – practitioner

COURSE DESCRIPTION AND OBJECTIVES
This course is complementary to the course of « Topics in data science ». The goal of this course is to make students work on projects related to the topics studied in the other course.

KEY PROFESSIONAL SKILLS UPON GRADUATION
To be able to tackle a data science problem and write a report to answer it.

ORGANIZATION
Semester: S2
Teaching Hours: 24 h of lectures
Comment: Class exclusive for Magistere students.