Euncet Business School

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UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

ASSET MANAGEMENT AND FINANCIAL AUTOMATION TEACHING GUIDE 2025-26

GENERAL DATA

Name:	Asset Management and Financial Automation
Code:	801885
Course:	2025-26
Titration:	Master's Degree in Financial Innovation and Fintech
Number of credits (ECTS):	5
Location in the curriculum:	1st year 1st semester
Department:	
Head of department:	
Date of last revision:	March 2025
Teaching staff:	Gerard Albà (Mathematician, CIO MoraBanc), Arnau Via (Mathematician, Peersyst and Milgauss), Fernando López (Mathematician, MoraBanc), Paul Gantheil (Finance, Superprof)

1. OVERVIEW

This subject provides advanced training in quantitative techniques applied to asset management and the valuation and management of financial derivatives.

Key concepts such as volatility and correlation will be addressed, including the analysis of the volatility surface and the associated trading strategies.

The fundamental classical models of portfolio management (Markowitz, CAPM, APT, Black-Litterman) and performance evaluation metrics will be explored.

A significant portion of the course will be devoted to the applications of machine learning and automation in derivatives management, portfolio construction (HRP), the use of alternative data, and algorithmic trading.

Finally, these concepts will be connected with relevant practical cases such as roboadvisors, the collective investment industry and asset and liability management (ALM).

The subject combines theoretical rigor with practical applications, preparing students to face the challenges of modern quantitative finance.

2. OBJECTIVES

- Understand and analyze the different types of volatility and correlation and their importance in financial markets.

- Master classic and modern models of portfolio management and asset selection.
- Understand the operation and management of derivative products, including the calculation and interpretation of the Greek derivatives.
- Evaluate and apply performance metrics and attribution of results in asset management.
- Identify and analyze the applications of machine learning and automation in different areas of quantitative finance.
- Understand the structure and functioning of the investment industry and asset management in practice (Roboadvisors, Investment Funds, ALM).

3. LEARNING OUTCOMES

At the end of the subject the student will be able to:

K5.1: Recognize the methods available for descriptive data analysis and visualization through Excel, Power BI, or other visualization platforms.

K5.2: Distinguish the use cases of machine learning, artificial intelligence, and predictive methods in finance.

S1.1: Communicate effectively orally, in writing and graphically with other people about learning, thinking and decision-making, and participate in debates, making use of interpersonal skills, such as active listening and empathy, which favour teamwork.

S2.1: Develop the capacity to contribute to innovation in new or existing business institutions and organizations, through participation in creative projects and have the ability to apply skills and knowledge on technology-based business sales, organization and development.

S3.1: Understand advanced digital technologies, so that they can be applied with a critical perspective, in diverse contexts, in academic, professional, social or personal situations.

S8.1: Develop artificial intelligence (AI) to improve productivity and define new financial products.

S8.2: Program quantitative models for data analysis and basic visualization that allow decision-making and predictions.

C1.1: Integrate the values of sustainability, understanding the complexity of systems, in order to undertake or promote actions that restore and maintain the health of ecosystems and improve justice, generating diverse visions for sustainable futures.

C2.1: Identify and analyse problems that require autonomous, informed and reasoned decision-making, in order to act with social responsibility, in accordance with ethical values and principles.

C3.1: Develop the capacity to assess gender and gender inequalities and to design solutions.

C6.1: Efficiently manage the company's active and passive financial resources, ensuring compliance with applicable regulations and sustainability.

C7.2: Apply data analysis techniques, artificial intelligence, and machine learning fundamentals to analyze and predict trends in financial markets and make informed decisions in the management of technology investments and business finance.

We can highlight:

- Calculate and interpret the historical and implied volatility of financial assets.
- Analyze the surface of volatilities and identify trading opportunities.
- Manage a simple derivatives book, calculating and interpreting its (Greek) sensitivities.
- Apply volatility and correlation models in practical contexts.
- Build and optimize investment portfolios using Markowitz's theory and factor models (CAPM, APT).
- Implement the Black-Litterman model to incorporate market insights into portfolio management.
- Evaluate the performance of portfolios and managers using standard metrics for attribution of results (Sharpe, Treynor, Jensen's Alpha, Information Ratio, etc.).
- Identify how machine learning can be used to improve derivatives management, portfolio construction (HRP), use of alternative data, and development of algorithmic trading strategies.
- Explain how robo-advisors work and their implications for the industry.

- Describe the structure of the collective investment industry and the roles of its participants. The management of alternative assets or private markets will be addressed in an introductory way.

- Understand the basic principles of asset and liability management (ALM).

4. CONTENTS

TOPIC 1: VOLATILITY AND CORRELATION

Specific learning outcomes:

- Gain an in-depth understanding of the concepts of historical and implied volatility, including the surface of volatilities and their application in derivatives management.
- Analyze the importance of the correlation between assets in risk and asset management.
- Apply volatility models and machine learning techniques for the efficient management of derivatives portfolios.

Contents:

1. Historical volatility: Definition and calculation.

1.2. Implied volatility and the surface of volatilities:

1.2.1. Case study. Management of a derivatives book. The Greeks.

1.2.2. Volatility models (e.g., GARCH).

1.2.3. Volatility Trading Strategies.

1.3. Historical and implicit correlations: Measurement and analysis.

1.4. Applications of machine learning to derivatives management: Volatility and correlation prediction.

TOPIC 2: DIGITAL TRANSFORMATION AND DIGITAL ECONOMY

Specific learning outcomes:

- Master fundamental asset management models, including Markowitz's portfolio theory, CAPM and APT factor models, and the Black-Litterman model for strategic asset allocation.
- Evaluate and apply various management metrics and outcome attribution techniques to analyze the performance of investment portfolios.

- Integrate the use of alternative data and machine learning techniques, including HRP portfolios, to optimize asset management and investment decision-making.

Contents:

2.1. Assets in a single period. Gaussian model: Expected return and risk.

2.2. Diversification. Markowitz's portfolio theory. The efficient frontier: Optimal asset allocation.

2.3. Quantitative factor models. CAPM and APT: Identification of risk and performance factors.

2.4. Black-Litterman: Combination of market equilibrium and investor opinions.

2.5. Attribution of results and management metrics: Evaluation of portfolio performance.

2.6. Applications of machine learning to asset management:

2.6.1. Use of alternative data for decision-making.

2.6.2. HRP diversification and portfolio construction techniques.

2.6.3. Development of algorithmic trading strategies.

TOPIC 3: REGULATION AND ECONOMIC POLICY

Specific learning outcomes:

- To apply theoretical knowledge in a practical way in the resolution of real cases related to asset management, including the use of robo-advisors and asset and liability management (ALM).
- Understand the functioning and characteristics of the collective investment industry, including the roles of unit-holders, the management company and the depositary, as well as alternative management (private markets)
- Analyze asset and liability management (ALM) strategies and liquidity management in financial institutions.

Contents:

- 3.1. Robo-advisors in asset management: Business models and investment strategies.
- 3.2. The collective investment industry. Unitholders, management company and depositary. Operating characteristics. Alternative Management: Investment funds and other institutions.

- 3.3. Liquidity asset liability management (ALM): Strategies for managing liquidity and interest rate risk.

5. TEACHING AND LEARNING METHODOLOGY

Teaching is carried out through a series of face-to-face sessions, whose spirit is to combine theory and practice in a balanced way, complemented by a series of didactic materials (manual and presentation), exercises and cases for their resolution, provided online and with *feedback*, also online, using the program's own platform as a digital support.

The face-to-face activities will be carried out through:

- Presentation by the teacher of the practical application of the theoretical contents of the different topics of the subject. It is essential that the student reads beforehand (by the student) the reference manual for each topic that is available in the virtual classroom.
- Discussion of content.
- Application of concepts and methodologies to examples/case studies

Learning will be consolidated through the resolution of the exercises and/or cases that will be provided on the virtual campus of the subject.

6. EVALUATION

In accordance with the Bologna Plan, the model rewards the constant and continuous effort of students. 60% of the grade is obtained from the continuous evaluation of the directed activities and the remaining 40% from the final face-to-face exam. The final exam has two sittings.

The final grade of the subject (NF) will be calculated based on the following formula:

- **NF = Final Exam Grade x 40% + Continuous Evaluation Grade x 60%**
- The minimum grade of the final exam to calculate the NF will be 40 points out of 100.
- The subject is approved with an NF equal to or greater than 50 points out of 100.

Type of activity	Description	% Continuous evaluation	
Questionnaires:			**60%**

Questionnaire 1	Test Topic 1	20%	
Questionnaire 2	Test Topic 2	20%	
Questionnaire 3	Test Topic 3	20%	
Final examination			**40%**
	Final examination	100%	

7. BIBLIOGRAPHY

7.1. BASIC BIBLIOGRAPHY

Derivatives and Volatility:

Hull, J.C. (Última Edición). Options, Futures, and Other Derivatives. Pearson.

Taleb, N.N. (1997). Dynamic Hedging: Managing Vanilla and Exotic Options. Wiley.

Portfolio Management:

Bodie, Z., Kane, A., Marcus, A.J. (latest edition). Investments. McGraw-Hill.

Grinold, R.C., Kahn, R.N. (2000). Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk. McGraw-Hill.

Litterman, R. (Ed.). (2003). Modern Investment Management: An Equilibrium Approach. Wiley. (Para Black-Litterman)

Quantitative Finance and ML:

López de Prado, M. (2018). Advances in Financial Machine Learning. Wiley.

7.2 ADDITIONAL BIBLIOGRAPHY

Ang, A. (2014). Asset Management: A Systematic Approach to Factor Investing. Oxford University Press.

Chan, E. (2013). Algorithmic Trading: Winning Strategies and Their Rationale. Wiley.

Chan, E. (2017). Machine Trading: Deploying Computer Algorithms to Conquer the Markets. Wiley.

Fabozzi, F.J., Focardi, S.M., Kolm, P.N. (2010). Quantitative Equity Investing: Techniques and Strategies. Wiley.

Meucci, A. (2009). Risk and Asset Allocation. Springer. (Relevant to HRP and advanced techniques.)

Revistas académicas y profesionales: Journal of Portfolio Management, Journal of Derivatives, Quantitative Finance, The Journal of Financial Data Science, Wilmott Magazine.