

---

## Algorithmic Trading & Market Modelling

**Professor:** Gerard Sánchez Vidal

**Email:** [Stream88rt@gmail.com](mailto:Stream88rt@gmail.com)

**Office hours:** by appointment

---

### Course Description

This course provides a comprehensive introduction to market analysis, portfolio metrics, technical analysis, and quantitative strategies, with a focus on understanding market dynamics and applying data-driven methods to investment strategies. Building on this foundation, the course delves into market modelling, examining the influence of external factors such as SEC meetings, earnings reports, the presidential cycle on financial markets, etc...

Additionally, the course introduces quantitative finance concepts, offering a structured approach to interpreting financial statements through Value Quant. Emphasis is placed on backtesting and developing robust quantitative strategies. Students will build their own market screener and backtesting module, exploring both idea-driven and data-driven strategies, with a focus on enhancing robustness through synthetic data and return permutation techniques.

### Course objectives

This course aims to provide you with unique skills and valuable insights to understand the rapidly growing field of algorithmic trading and market modelling. You will become familiar with key concepts related to market dynamics, portfolio metrics, technical analysis, and quantitative strategies. As you progress, you'll learn how to integrate these elements into the financial decision-making process for both public and private investors. You'll gain an understanding of the external factors that influence markets, such as regulatory announcements, macroeconomic data, and political cycles.

Additionally, the course will equip you with tools to build quantitative models, backtest strategies, and enhance their robustness using synthetic data and

return permutation techniques. You will also create custom market screeners and develop algorithmic trading strategies that can be applied in real-world scenarios.

**Having successfully completed this course, you will:**

- (i) Have acquired knowledge of the key concepts related to algorithmic trading, market dynamics, and quantitative strategies.
- (ii) Understand how external factors, such as macroeconomic data and regulatory announcements, influence market behavior and how to integrate them into financial models.
- (iii) Be able to develop and backtest algorithmic trading strategies using Python, ensuring robustness through synthetic data generation and advanced validation techniques.
- (iv) Be capable of building and applying market screeners to identify investment opportunities based on both data-driven and idea-driven strategies.
- (v) Master the use of technical analysis and portfolio metrics, applying them to enhance portfolio performance and assess risk in different market environments.

## Methodology

You will learn through a series of lectures, relevant examples, and case studies, designed to apply your newly developed skills to address real-world financial problems.

Lectures will mainly develop the concepts and methodologies that make up the items of the course list. These sessions are based on the textbook, but we have prepared a set of slides that set out the main material more specifically. The slides should be the fundamental support for personal preparation before and/or after the lectures.

The module requires the preparation of business case studies. Resolutions of the cases will be presented in groups. During those sessions, we will also encourage student participation in the discussions, which will be evaluated individually.

## Evaluation criteria

(A) Active participation in class discussions is valued since it contributes to overall learning. We will judge your performance based both on the quality and the quantity of your comments. This will account for 30% of the grade.

(B) We will also solve real business cases. Students will need to prepare a solution and be ready for group discussion. The preparation of the solutions of the case can be done in groups. This will account for 30% of the grade.

(C) The solutions of the business cases will also be presented. The presentation of the case can also be done in groups. This will account for 40% of the grade.

Students are required to attend 80% of classes. Failing to do so without justified reason will imply a Zero grade in the participation/attendance evaluation item and may lead to suspension from the program

As with all courses taught at the UPF BSM, students who fail the course during regular evaluation will be allowed ONE re-take of the examination/evaluation. Students that pass any Retake exam should get a **5 by default as a final grade for the course**. If the course is again failed after the retake, students will have to register again for the course the following year.

Plagiarism is to use another's work and to present it as one's own without acknowledging the sources in the correct way. All essays, reports or projects handed in by a student must be original work completed by the student. By enrolling at any UPF BSM Master of Science and signing the "Honor Code," students acknowledge that they understand the schools' policy on plagiarism and certify that all course assignments will be their own work, except where indicated by correct referencing. Failing to do so may result in automatic expulsion from the program."

## Calendar and Contents

Tentative topics:

### Understanding the basics of the market:

- OHLCV data, Candlesticks, spreads, order types, asset classes, liquidity, bid/ask...
- Analyzing the returns (market movements): Intraday, overnight, close to close...
- Descriptive statistics + analyzing distributions.
- Most common portfolio metrics: Sharpe, Sortino, DD...
- Technical analysis: Market breadth, indicators... percentil study.

### Modelling the market:

- Best and worse days.
- The impact of SEC meetings.
- Presidential American cycle: Impact on the markets.

- The impact of earnings (parsing the f.statements of the SEC API)
- The GOD's portfolio... backtesting biases.
- Building our own market screener.
- An introduction to Value Quant: Understanding financial statements with a quantitative perspective.

#### **Introduction to Backtesting and Quantitative strategies:**

- Idea driven vs data driven strategies.
- The concept of IS and OOS.
- Building our own backtesting module.
- Developing Quantitative strategies and backtest them.
- Improving robustness: Synthetic data through return permutation and other techniques

### **Reading Materials**

#### **Biography of the Professors**

Gerard Sánchez Vidal – Associate Professor

Graduated in Business Administration and Management and Master's in International Finance from EADA. Director of training at IVEAEMPA. Extensive experience as a professor and instructor, delivering Python training with a specialization in finance. Content creator with years of experience on social media (@Gsnchez). Professor in the M.Sc. Finance & Banking at Pompeu and MEFF UNAV.