ADVANCED TOPIC: FINANCIAL ANALYTICS

Bachelor in Data and Business Analytics BDBA SEP-2023
FA-DBA.4.M.A

Area Others
Number of sessions: 15
Academic year: 23-24
Degree course: FOURTH
Number of credits: 3.0
Semester: 2º
Category: COMPULSORY
Language: English

Professor: **MANOEL FERNANDO GADI ALONSO**

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Academic Background:

- Executive MBA, Business Administration and Management, IE Business School, Spain
- Master in Computer Science and Statistics, University of Sao Paulo, Brazil
- Computer Science Degree, University of Sao Paulo, Brazil

Academic Experience:

- Risk & Fraud Analytics - Master in Business Analytics & Big Data at IE Business School
- Statistical Programming Python - Master in Business Analytics & Big Data at IE Business School
- Building a Fintech - Master in Business Analytics & Big Data at Universidad de Alcalá de Henares
- Math and Stats for Big Data - Master in Business Analytics & Big Data at U-TAD

Corporate Experience:

- Founder and CEO of Suncaged Analytics Consulting Europe (Madrid: 2019-curr)
- Director of Analysis & Reporting, Altamira Real Estate (Madrid: 2018-2019)
- Director of Credit Rating, Big Data and Business Analytics, Bravo Capital (Madrid: 2015-2018)
- Head of R&D for Risk Analytics Area, Santander Bank Headquarters Spain (Madrid: 2012-2015)
- R&D Risk Analytics Area Manager, Santander Bank United Kingdom (Milton Keynes: 2008-2012)
- Credit Risk Modelling Manager, Santander Bank Brazil (Sao Paulo: 2007-2008)
- Credit Risk Supervisor, ibi bank (C&A group) (Sao Paulo: 2006-2007)
- Credit Card Risk analyst, Citibank Brazil (Sao Paulo: 2003-2005)

Office Hours

Office hours will be on request. Please contact at:

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SUBJECT DESCRIPTION

Finance is a vast subject that involves the management, creation, and study of money and investments, including acquiring capital and spending or investing that money. Financial markets serve as the means to facilitate the flow of money through investments and other financial instruments between different parties. Financial instruments are monetary contracts that can be created, traded, modified, and settled. These instruments include cash, ownership interests in an entity, contractual rights to receive or deliver currency, debt such as bonds and loans, equity such as shares, and derivatives such as options, futures, and forwards. This diversity of financial instruments enables the flow of money through economies worldwide.

Recent technological advances have propelled finance into a new era, driven by two major forces. The first is programmatic access to real-time financial data, which generates vast amounts of data that humans alone cannot process. As a result, computational power and algorithms increasingly drive financial markets instead of human traders. The second force is the growing importance of artificial intelligence in finance. An increasing number of financial institutions are investing in machine learning (ML) and deep learning (DL) algorithms to improve their operations, trading, and investment performances.

This course covers essential topics in Financial Data Science that are at the core of these technological evolutions, including financial data and preprocessing, technical analysis, financial time series modeling, factor models and volatility modeling, Montecarlo simulations, asset allocation and portfolio optimization, and financial machine learning.

LEARNING OBJECTIVES

The course aims to cover the basic techniques involved in Financial Data Science with a practical emphasis on their application, starting with traditional methods such as time series analysis and factor models and progressing to more modern techniques such as machine learning. The objective is to provide students with an adequate understanding of theory and data analytics knowledge previously acquired to determine which technique best solves a specific problem.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course. This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

Learning Activity	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	26.67 %	20.0 hours
Discussions	6.67 %	5.0 hours
Exercises in class, Asynchronous sessions, Field Work	6.67 %	5.0 hours
Group work	46.67 %	35.0 hours
Individual studying	13.33 %	10.0 hours
TOTAL	100.0 %	75.0 hours

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Financial Data Science

The session begins by introducing the course, its objectives, methodology, and evaluation. The second part of the session focuses on introducing Finance, including markets and instruments, and how data science is transforming the field.

SESSION 2 (LIVE IN-PERSON)

Financial data and preprocessing

In this session we explore how financial data is different from other types of data commonly used in machine learning tasks. We will learn the different techniques to access financial data from different sources and how to preprocess it for further analysis.

SESSION 3 (LIVE IN-PERSON)

Financial data and preprocessing (Practice)

In this session we put in practice what we have learnt in the previous session. We will download data for different instruments and preprocess it using Python.

SESSION 4 (LIVE IN-PERSON)

Technical analysis

Technical analysis is commonly used by traders and when creating trading systems. In this session we demonstrate some fundamental basics of technical analysis as well as how to create elegant dashboards in Python. We will be able to draw some insights into patterns emerging from a selection of the most commonly used metrics.

SESSION 5 (LIVE IN-PERSON)

Technical analysis (Practice)

In this session we put in practice what we have learnt in the previous session. Students will perform technical analysis of different instruments.

SESSION 6 (LIVE IN-PERSON)

Financial time series modelling

Traditionally financial applications have been addressed using methods from Econometrics. This session introduces the basics of time series modeling. Then, we look at two of the most widely used approaches of time series modeling, exponential smoothing methods and ARIMA class models. We present Python libraries to perform different statistical analyses and time series forecasting.

SESSION 7 (LIVE IN-PERSON)

Financial time series modelling (Practice)

In this session we put in practice what we have learnt in the previous session. We will use Python to perform financial time series analysis.

SESSION 8 (LIVE IN-PERSON)

Factors models and volatility modelling

In the first part of this session we will introduce factor models. Factor models are financial models that use factors (technical, fundamental, macroeconomic or alternate) to define a security's risk and returns. These models are linear, as they define the securities returns to be a linear combination of factor returns weighted by the securities factor exposures. We will estimate various factor models starting with the simplest one-factor model and then explain how to estimate more advanced three-, four-, and five-factor models.

In the second part of the session we address volatility modelling. We introduce the concept of volatility forecasting using (G)ARCH class models, how to choose the best-fitting model, and how to interpret your results.

Factors models and volatility modelling (Practice)

In this session we put in practice what we have learnt in the previous session. We will learn how to create factor models and model volatility with GARCH using Python.

SESSION 9 (LIVE IN-PERSON)

Factors models and volatility modelling

In the first part of this session we will introduce factor models. Factor models are financial models that use factors (technical, fundamental, macroeconomic or alternate) to define a security's risk and returns. These models are linear, as they define the securities returns to be a linear combination of factor returns weighted by the securities factor exposures. We will estimate various factor models starting with the simplest one-factor model and then explain how to estimate more advanced three-, four-, and five-factor models.

In the second part of the session we address volatility modelling. We introduce the concept of volatility forecasting using (G)ARCH class models, how to choose the best-fitting model, and how to interpret your results.

Factors models and volatility modelling (Practice)

In this session we put in practice what we have learnt in the previous session. We will learn how to create factor models and model volatility with GARCH using Python.

SESSION 10 (LIVE IN-PERSON)

Asset allocation and portfolio optimization

Investments in real life are done using a set of assets pulled in a portfolio to diversify risk. In this session we introduce Modern Portfolio Theory (MPT) and show how to obtain the Efficient Frontier and identify specific portfolios, such as minimum variance or the maximor Sharpe ratio. We also show how to evaluate the performance of such portfolios.

Asset allocation and portfolio optimization (Practice)

In this session we put in practice what we have learnt in the previous session. We will learn how to do portfolio analysis using Python.

SESSION 11 (LIVE IN-PERSON)

Asset allocation and portfolio optimization

Investments in real life are done using a set of assets pulled in a portfolio to diversify risk. In this session we introduce Modern Portfolio Theory (MPT) and show how to obtain the Efficient Frontier and identify specific portfolios, such as minimum variance or the maximor Sharpe ratio. We also show how to evaluate the performance of such portfolios.

Asset allocation and portfolio optimization (Practice)

In this session we put in practice what we have learnt in the previous session. We will learn how to do portfolio analysis using Python.

SESSION 12 (LIVE IN-PERSON)

Financial machine learning

In this session we introduce advanced techniques in financial analytics. We will explore applications of Machine Learning in finance, such as price prediction or portfolio selection.

SESSION 13 (LIVE IN-PERSON)

Financial machine learning (Practice)

In this session we put in practice what we have learnt in the previous session. We will use machine learning to address different problems in finance.

SESSION 14 (LIVE IN-PERSON)

Final Exam (Quiz)

In this session we do an in-class exercise/exam with all the course content.

SESSION 15 (LIVE IN-PERSON)

Group work presentation

EVALUATION CRITERIA

Your final grade in the course will be based on both individual and group work of different characteristics that will be weighted in the following way:

criteria	percentage	Learning Objectives	Comments
Final Exam	40 %		
Group Presentation	40 %		
Class Participation	20 %		

RE-SIT / RE-TAKE POLICY

A. Class participation and discussion

Class participation will be evaluated based on the following criteria:

Quality (not quantity) of your participation in class discussion: The most important dimension of participation concerns what it is that you are saying. A high quality comment reveals depth of insight, rigorous use of case evidence, consistency of argument, and realism. Frequency refers to the attainment of a threshold quantity of contributions that is sufficient for making a reliable assessment of comment quality. The logic is simple: if contributions are too few, one cannot reliably assess the quality of your remarks. However, once threshold quantity has been achieved, simply increasing the number of times you talk does not automatically improve your evaluation. Beyond the threshold, it is the quality of your comments that must improve. In particular, one must be especially careful that in claiming more than a fair share of “airtime”, quality is not sacrificed for quantity. Finally, your attempts at participation should not be such that the instructor has to “go looking for you”. You should be attempting to get into the debate on a regular basis.

You might want to avoid being classified as one of the following types of students:

- Repeaters, i.e., students that, consciously or unconsciously, make comments that are really just repeats/rephrasing of what has already been said (by other students, or you). This wastes time and adds nothing to learning.
- Ramblers, i.e., students that take a lot of time to say simple things or they may tell long personal/professional stories, or they roam into topics that are not relevant, or simply make low-quality comments just to participate. They waste valuable time and prevent other students from being able to participate.
- Students that have been distracted (by social networks, etc.) or who have stopped paying attention and then, later on, when they realized they have missed a term or concept, they ask you about it.

B. Final exam

Students will be asked to complete quizzes to assess the overall understanding of the subject being studied.

C. Group Work

The group project is an integral part of this course. Each group will be asked to work on a project, prepare and deliver a presentation.

BIBLIOGRAPHY

Compulsory

- Yves Hilpisch. (2019). *Python for Finance. Mastering Data-Driven Finance.* 2nd edition. O'Reilly Media, Inc, USA. ISBN 1492024333 (Digital)

- Eryk Lewinson. (2020). *Python for Finance Cookbook: Over 50 recipes for applying modern Python libraries to financial data.* 1st. Packt. ISBN 1789618517

(Digital)

- Yves J. Hilpisch. (2010). *Artificial Intelligence in Finance: A Python-Based Guide.* First. O'Reilly Media, Inc, USA. ISBN 1492055433 (Digital)

Recommended

- Marcos M López de Prado. (2020). *Machine Learning for Asset Managers.* First. Cambridge University Press. ISBN 1108792898 (Digital)
- Matthew F. Dixon, Igor Halperin, Paul Bilokon. (2020). *Machine Learning in Finance: From Theory to Practice.* 1st. Springer. ISBN 3030410676 (Digital)
- Frederic Mishkin. (2018). *Financial Markets and Institutions.* Pearson. ISBN 1292215003 (Digital)
- Irene Aldridge. (2021). *Big Data Science in Finance.* First. John Wiley & Sons Inc. ISBN 9781119602989 (Digital)

BEHAVIOR RULES

Please, check the University's Code of Conduct here. The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy here. The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code here. The Program Director may provide further indications.