

MScFE 600 Financial Data Syllabus

Course Overview

This course introduces students to empirical data that can be used for decision making and predictions in finance. Data sets include traditional time series of financial series and macroeconomics, as well as alternative data including text, social media, images, geolocation data, and climate data. Students will learn how to apply Python to properly select, import, filter, structure, visualize, summarize, and analyze data sets for interest rates, equities, cryptocurrencies, ETFs, securitized products, and other asset classes. Students will also learn how to prepare both numeric and non-numeric data to be used in models for financial markets, including fundamental analysis with accounting data, technical analysis with trading data, statistical analysis with transformed data, and sentiment analysis with textual data. The course builds upon the prerequisites of the program by illustrating how linear algebra, probability and statistics can be used to transform and filter data, and impute missing values, so that data is model-ready. Emphasis will be given on several matrix transformations that provide normalization, transformation, reduction, factorization, and interpolation to enhance the data's effectiveness in models. In addition, visualization techniques through Python will develop the presentation of data for both technical and non-technical audiences. The ultimate goal of this course is to build foundational skills that enable students to understand the type of data needed depending on their goals, how to source it, structure it, process it, build with it, and discover what it tells. At their best, financial engineers turn a rich variety of data into empirically based, well-calibrated financial models whose output provides traders, portfolio managers and risk managers with sound decisions in the uncertain world of finance.

Credits	4 Semester Credit Hours
Course Materials	Lesson notes, required readings (Open Access), additional free online resources to deepen existing course content
Methods of Instruction	Video lectures, live sessions, screencasts, interactive models
Methods of Assessment	Quizzes, collaborative review tasks, group work projects
Curriculum Revision Date	December 3, 2024
Prerequisites	MScFE 560 Financial Markets

Course Learning Outcomes

Upon successful completion of the course, you will be able to:

CLO 1	Illustrate the types of data used in financial engineering including financial and alternate data sets ranging from structured to unstructured
CLO 2	Develop Python proficiency to perform importing, structuring, visualizing, and reporting of both traditional and alternative data
CLO 3	Use fundamental, technical, statistical, and sentiment analysis to find patterns and insights in financial markets using time series and alternative data
CLO 4	Identify areas of best ethical practices regarding the creation, use, handling, and distribution of data and reporting of models

Module Objectives

Upon completion of each module in the course, you will be able to:

Module 1: Fixed Income Data	<ul style="list-style-type: none"> • Outline best practices for working with data used in financial engineering • Provide background for the influences, sources, and structure of government fixed income data • Fit a yield curve two ways: using Nelson-Siegel and using Cubic splines • Apply principal components to understand the shapes, movements, and risks of the Treasury market
Module 2: Equities and Cryptocurrencies	<ul style="list-style-type: none"> • Process equity and cryptocurrency data and compute their returns and other statistical properties • Statistically analyze returns for their correlations and distributions • Apply Cholesky factorization for the simulation of data • Recognize areas requiring best ethical practices with data

Module 3: Working with Portfolios and Tick Data	<ul style="list-style-type: none"> • Develop specific measures to quantify correlation, diversification and other portfolio measures like the efficient frontier • Compute the Value at Risk using different methodologies • Learn the types and processing of tick data • Apply singular value decomposition to data and compare with PCA
Module 4: Alternative Data	<ul style="list-style-type: none"> • Define role of social media in financial engineering • Discuss methods of similarity measures and applications of Term Frequency-Inverse Document Frequency (TF-IDF) for analyzing text data • Apply Search engine data and alternative data to financial case studies
Module 5: News Data and Sentiment Analysis	<ul style="list-style-type: none"> • Apply Non-Negative Non-Negative Matrix Factorization for portfolio diversification • Incorporate news data into models for sentiment analysis • Work with large-scale news data collections • Outline key critical thinking skills used by industry
Module 6: Geospatial and Satellite Data	<ul style="list-style-type: none"> • Illustrate an example of geospatial data • Outline the types and processing of spatial data • Illustrate a geospatial weighted regression applied to finance • Identify common causes of model failure and crises, emphasizing the essential need for data
Module 7: Integrating Ethics and Critical thinking with Financial Data	<ul style="list-style-type: none"> • Describe the types and sources of climate data • Apply matrix normalization and compression techniques to climate data • Illustrate numerical methods for data preparation and statistical analysis, covering data cleaning, data engineering, and exploratory data analysis • Describe numerical methods for core modeling, model refinement, and model optimization • Emphasize the importance of both technical and soft skills in building a professional foundation in financial engineering

Credit Hour Policy

WorldQuant University awards semester credit hours. A 4-semester credit hour course requires students to spend approximately 180 hours engaged in coursework over 7 weeks (**ca. 25 hrs/week**). Coursework includes 60 hours of academic engagement (i.e., instructor-led activities such as watching video lectures, participating in interactive discussions via the forums) and 120 hours of preparation (i.e., completing reading assignments, conducting research, completing projects). Note that these are average times, derived from generally accepted average standards.

	Activity	Average hours	Est. hours/course
Academic Engagement	Watching and mastering video lectures and online multimedia content	2 hr/week	14
	Participating in discussion forums with instructors and peers	2 hr/week	14
	Seeking clarification about course content	1 hr/week	7
	Participating synchronously in Live Session or watching it asynchronously	2 hr/week	14
	Taking graded quizzes	2 hr/week	14
	Total		63 hours (60h target)
Preparation	Reading and mastering Lesson Notes and Required Readings (includes preparing to take graded quizzes)	6 hrs/week	42
	Completing 2 CRT assignments	3 hrs/assignm.	6
	Reviewing 4 CRT assignments from peers	1 hr/assignm.	4
	Performing research and developing 3 Group Work Projects	6 hrs/project	18
	Developing code, executing it, and analyzing obtained results	3.5 hr/week	24.5
	Collaborating with teammates via discussion forums to complete the Group Work Projects	2 hr/week	14
	Completing Practice Quizzes	2 hr/week	14
	Total		122.5 hours (120h target)

Graded Assessments and Grading Policies

Assessments and Deadlines

The chart below lists the graded assessments that are required for course completion and their associated Modules along with the deadlines for submission.

Submission Deadlines		
Module	Assessment	Deadline
Module 1	Quiz M1	Monday (Day 7)
Module 2	CRT1 (Submission)	Monday (Day 14)
	Quiz M2	Saturday (Day 19)
Module 3	CRT1 (Assessment)	Monday (Day 21)
	Quiz M3	Saturday (Day 26)
Module 4	CRT 2 (Submission)	Monday (Day 28)
	Quiz M4	Saturday (Day 33)
Module 5	CRT2 (Assessment)	Monday (Day 35)
	GWP1	Tuesday (Day 36)
	Quiz M5	Saturday (Day 40)
Module 6	Quiz M6	Saturday (Day 47)
Module 7	GWP2	Tuesday (Day 50)
	Quiz M7	Saturday (Day 54)

The deadline to earn participation points is the final day of the course (Day 54**)*

*** All submission deadlines are set to 23:59/11:59 pm in the Universal Time Zone Coordinated (UTC). Note that UTC is also called Greenwich Mean Time (GMT). For example, if you live in New Jersey, US, during the winter months (GMT-5:00) all deadlines will appear at 6:59 pm, while during the summer months (GMT-4:00) they will appear as 7:59 pm due to the Daylight Saving Time (DST) used in the state of New Jersey. As another example, if you live in India (GMT+5:30) all deadlines will appear as 5:29 am throughout the year since India does not use the DST during the summer months.*

Check your calendar to view the deadlines in your time zone, and make sure to take into account the DST if used in your country or US state.

Grading Criteria: Point Distribution and Grading Scale

You can view your progress (points earned and percentage towards final grade) by clicking “Grades” under your name on the top right of your screen. To successfully pass this course, you must earn a final grade of **70%** or above.

Graded assessments are reflected in your final course grade as follows:

Point Distribution		
Graded Assessment	Points	Percentage
Participation in discussion forums	108	
Participation Total	108	11%
Quiz M1	57	
Quiz M2	57	
Quiz M3	58	
Quiz M4	58	
Quiz M5	58	
Quiz M6	58	
Quiz M7	58	
Quiz Assignment Total	404	40%
Collaborative Review Task 1 (Submission)	70	
Collaborative Review Task 1 (Assessment)	30	
Collaborative Review Task 2 (Submission)	70	
Collaborative Review Task 2 (Assessment)	30	
Collaborative Review Total	200	20%
Group Work Project – Submission 1	120	
Group Collaboration for Submission 1	24	
Group Work Project – Submission 2	120	
Group Collaboration for Submission 2	24	
Group Work Project Total	288	29%
Course Total	1000	100%

The table below shows how your final grade percentage will be evaluated:

Grading Scale	
Grade Percentage	Designation
90-100	Excellent
80-89	Proficient
70-79	Satisfactory
0-69	Unsatisfactory
Withdrawal*	W

* Students may withdraw from a course before the end of Week 3.

FFE Certificate Completion and MScFE Matriculation

To earn the Foundations of Financial Engineering Certificate, students must:

- Complete the first two courses in the program (*MScFE 560: Financial Markets* and *MScFE 600 Financial Data*) **with a cumulative average score of 80% or above.**

Students are allowed to proceed in the Master of Science in Financial Engineering and become fully matriculated upon meeting the above mentioned requirements.

Satisfactory Academic Progress (SAP) Requirements

Students are required to maintain Satisfactory Academic Progress throughout the completion of the Master of Science in Financial Engineering Program:

- Maintain a cumulative average score of **80%** or above
 - Failure to meet this requirement may result in program withdrawal (see SAP policy in the [University Catalog](#), page 33)
- Complete the Program within the **Maximum Time Frame (MTF)** of 150% (3 years) of the scheduled program length of two (2) years at a pace of 13 semester credits minimum earned every year

Academic Integrity and Student Responsibilities

Commitment to the principles of academic honesty and integrity is essential to the mission of WQU. All work submitted in a course must be the student's own work.

Plagiarism is the act of presenting another person's ideas, research, or writing as your own. You commit plagiarism when you:

- copy a statement or paragraph created by another person without using quotation marks and a reference to the original author's source material;
- present the ideas of another person in your own words without giving credit;
- use information that is not considered common knowledge without giving credit to the source;
- purchase a paper from the internet or a vendor and submit it as a personal paper.

To plagiarize or to copy the work of another person or from any AI source and to present it as your own is a violation of academic integrity. The penalty for the first violation is course failure; a second violation may result in being terminated from the program. Refer to the [University Catalog](#) for a detailed list of consequences for academic integrity violation.

To gain a deeper understanding of plagiarism and how to avoid it, watch this [video tutorial](#), read these [Help Articles](#), and use this [Anti-Plagiarism Guide](#) to learn how to include in-text citations and references.

Below, you can find some tips on what you should and should not do to avoid plagiarism:

DO	<ul style="list-style-type: none">• Include statements (1-2 lines at most) from books or articles published by others, as long as: 1) you use quotation marks (" "); 2) you add in-text citation to ensure the reader knows that it is not yours; and 3) include a complete reference at the bottom of the paper. The statement should be used to boost or amplify your own personal opinion or argument.• Paraphrase the idea of another person as long as it is used to bolster your own ideas, and cite the original work with both in-text citations and reference.
DON'T	<ul style="list-style-type: none">• Copy and paste from articles, books, or other sources without proper citations and references.• Extensively cite or paraphrase entire paragraphs, even if the paragraph is within quotation marks and cited.• Include a graph or a table with data from a work published by others.

Use of Turnitin

At the time of submission, all group work assignments are run through Turnitin, which is a plagiarism detection software. Turnitin creates a similarity report that matches the submitted paper against its database (peer-reviewed journals, textbooks, internet resources, etc.) as well as papers created by other students at WQU or in other institutions. Before the submission deadline, you can download and make use of the Turnitin similarity report to revise your final paper for grading. The similarity report shows a similarity score equal to the percentage of matching found with the resources described above.

You are responsible to:

- Understand what constitutes plagiarism. In addition to the tips provided in this syllabus, extensive information and tutorials are provided in the Student Resource Center, in the Orientation Course, and in the Course Overview section of the course;
- Review the Turnitin similarity report for each assignment before the submission deadline;
- Edit your work prior to the final submission to ensure that any statements from other authors are properly quoted, cited, and **mindfully used to support your original work rather than forming the basis of the argument itself.**

Based on the Turnitin similarity report, the Instructional Team will evaluate whether you have committed plagiarism and may decide to give you a failing grade for the assignment or for the entire course (see WQU Academic Integrity Policy in the [University Catalog](#)). Note that your instructors have access to the **Turnitin AI writing indicator** showing the portion of your submission that might be developed by AI with 98% probability.

Keep in mind that when you commit plagiarism, **your Academic Integrity status is changed to “Probation,” and a note is added in your records describing the violation.** This note may prevent you from receiving recommendation letters or alumni opportunities.

Student Code of Conduct

The Student Code of Conduct sets forth the standards of conduct expected of students at WQU. This code is not exhaustive, and you may be subject to disciplinary actions for other behavior and/or activities deemed unacceptable or disruptive to the goals and mission of WQU and the expectation of professionalism in the online learning environment.

If you violate the Student Code of Conduct, you will be subject to disciplinary actions including issuance of a warning, probation, termination, or permanent dismissal from the University. Any and all disciplinary actions will be recorded in your student academic record.

Violations of the Student Code of Conduct*

- All forms of violation of academic integrity including the following: cheating; fabrication; plagiarism; engaging in or facilitating academic dishonesty; republishing or redistributing any course materials, student's own work, or another student's work; and uploading WQU content to websites or linking to it through services.
- Sharing personal account information to access the online platform with anyone.
- Use of any religious, inflammatory, offensive, or flagrant language in the online learning environment, including discussion forums, or in private communications with the Instructional Team, the Academic Dean, or WQU Staff.
- Use of any religious, inflammatory, offensive, or flagrant language related to WQU or WQU representatives on social media or on WQU social media accounts.
- Endangering, threatening, or causing harm to any member of the WQU community, causing reasonable apprehension of such harm or engaging in conduct or communications that a reasonable person would interpret as a serious expression of intent to harm.
- Unauthorized use of University property and/or resources.
- Engaging in retaliation, harassment, or repeated contact that a reasonable person would understand to be unwanted, including stalking and/or sexual harassment.
- Engaging in any discriminatory activities as prohibited by applicable law or University policy.

- Engaging in any illegal sexual offense, including, but not limited to, sexual assault, public sexual indecency, or indecent exposure.
- Violation of any other University policy.
- Conduct that is illegal under state or local law.

**Refer to the [University Catalog](#) for a complete list of actions constituting violation of the Academic Integrity and Student Code of Conduct.*

Syllabus revision date: December 3, 2024