Master of Quantitative Finance

COURSE CODE: **QF 603**
COURSE TITLE: **Quantitative Analysis of Financial Markets**

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PRE-REQUISITE/CO-REQUISITE/MUTUALLY EXCLUSIVE COURSE(S)
None

COURSE AREA
M. Sc in Quantitative Finance Core

GRADING BASIS
Graded

COURSE UNIT
1 CU

FIRST OFFERING TERM
Academic Year: AY2024-25
Academic Term: August

COURSE DESCRIPTION
Many quantitative hedge funds, proprietary trading organizations, sell-side structurers, product specialists and financial risk management professionals seek to generate alpha and/or manage market risk consistently via analysis of financial time series and panel data sets. This course seeks to provide students with a rigorous econometric toolkit to achieve this in a way that is relevant to application in buy or sell-side financial institutions. Many techniques presented may also generalize to data science practices in major corporations.

The topics covered in this course include common econometric and statistical procedures such as parameter estimation, Bayesian analysis, GARCH models, volatility term structures, correlations and corpulas, and time series econometrics. After establishing a robust theoretical foundation, students will be provided with basic "example" implementations of these algorithms in class using a major industry relevant programming language (R/Python, although we may discuss in class pros/cons with Java/C++ as opportunity for discussion arises); students will then have the opportunity to enhance these framework code with what they have learned, and also apply the algorithms to actual financial time series.

With a view towards the dual purpose of this course in preparing students for taking the Quantitative Analysis (QA) assessment in the Financial Risk Management (FRM) syllabus, many topics in the course outline has been mapped to a specific FRM-QA area.

We will also overview neural networks and machine learning in our final 2 classes. Due to the nature of the material, these two topics will not be examinable, but may provide course participants with an expanded toolkit for industry practice and further research.

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Master of Quantitative Finance

This course pays special attention to the assumptions underlying the financial, economic, and econometric models. Where possible, we may use case studies of actual financial data or recent situations to illustrate economic intuition behind mathematical and statistical principles studied.

LEARNING OBJECTIVES

By the end of this course, students will be able to define, discuss, elaborate, and evaluate

- Discrete and continuous probability distributions
- Estimating the parameters of distributions
- Population and sample statistics
- Bayesian analysis
- Statistical inference and hypothesis testing
- Estimating correlation and volatility using EWMA and GARCH models
- Volatility term structures
- Correlations and copulas
- Linear regression with single and multiple regressors
- Time series analysis and forecasting

ASSESSMENT METHODS

Basis of Assessment

Class participation and discussion	15%
Homework assignments	25%
Group Project	20%
Final exam	40%

ACADEMIC INTEGRITY

All acts of academic dishonesty (including, but not limited to, plagiarism, cheating, fabrication, facilitation of acts of academic dishonesty by others, unauthorized possession of exam questions, or tampering with the academic work of other students) are serious offences.

All work presented in class must be the student's own work. Any student caught violating this policy may result in the student receiving zero marks for the component assessment or a fail grade for the course. This policy applies to all works (whether oral or written) submitted for purposes of assessment.

When in doubt, students are encouraged to consult the instructors of the course. Details on the SMU Code of Academic Integrity may be accessed at http://www.smuscd.org/resources.html.

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OPTIONAL TEXTS – In class provided material will be sufficient and self-contained, but the following may provide additional context:
(1) Mathematics and Statistics for Financial Risk Management by Michael Miller, John Wiley & Sons (2012)
(2) Introductory Econometrics for Finance 3nd edition by Chris Brooks, Cambridge University Press (2014)
(3) Options, Futures, and Other Derivatives, 10th Edition by John Hull, Pearson Prentice Hall, (2018)

TENTATIVE SCHEDULE

- Material in classes 8 and 9 will not be on the final examination but may provide course participants with an expanded toolkit for industry practice or further research.
- Classes 3 to 8 inclusive are blended learning involving 1.5 hours of in person meetings which are preceded by 1.5 hours of pre-programmed instruction which is asynchronous to cater to different initial backgrounds

Session No.	**Topic**
1	FRM QA-1 to QA-3 **Probabilities, Basic Statistics, Distributions**
2	FRM QA-4 and QA-5 **Hypothesis Testing and Confidence Intervals**
3	FRM QA-6 and QA-7 **Linear Regression with One/Multiple Regressor, Inference**
4	FRM QA-8 to QA-9 **Classical linear regression model assumptions and diagnostic tests**
5	FRM QA-10 to QA-12 **Modeling and Forecasting Trend, Seasonality and Characterizing Cycles**
6	FRM QA-13 to QA-14 **Modeling Cycles: MA, AR, ARMA and ARIMA Models**
7	FRM QA-13 to QA-14 **ECM, VECMs, GARCH**
8	Time series classification and clustering
9	Neural networks for forecasting
10	Presentation and Review