

FIN4124/4719 FINTECH AND FINANCIAL DATA ANALYTICS

AY2021/22 Semester 2

Class Meetings: BIZ1 #02-02; Tuesdays 1200-1500

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MODULE DESCRIPTION

This course covers analytical tools and innovations in finance that solve practical problems. The objective is to connect theory with practice by building models, testing them with data, and using them for financial decision-making. The topics include (1) efficient market hypothesis, (2) behavioral finance, (3) event studies, (4) Monte Carlo simulation, (5) artificial intelligence, (6) natural language processing, (7) digital payments, (8) cryptography and cybersecurity, (9) blockchain, and (10) real option. The course adopts a cookbook approach to model, code, and solve problems in finance.

This course aims to nurture a **product mindset** in developing data analytical solutions in finance. Students should be comfortable with statistics, the fundamental concepts in finance, the stock market, and programming (i.e., Python).

Each student should regularly contribute to classroom discussion in person or on Microsoft Teams. This is particularly true when we discuss assignments, but also during lectures and general discussions. The material for this course needs to be absorbed consistently. As the course progresses, students should work on the team deliverables to prepare for projects and quizzes. All these problems are essential for a full understanding of the material covered in the course. Students should find it helpful to read the assigned readings before we cover the material in class.

LEARNING OUTCOMES

1. Apply theories and concepts to study problems in finance.
2. Develop useful models to analyze and solve problems in finance.
3. Implement, assess, troubleshoot, and evaluate solutions.
4. Understand the key fintech concepts and their impact on the financial services sector.
5. Understand and develop products and businesses to unleash the potential of fintech in the financial services sector.

PREREQUISITE

You should be comfortable with tools for the analysis of data; familiarity with programming languages, like Python or R, will be needed. You should have taken one module in investment analysis (FIN3102 or FIN3702 or QF3101) and one module in data analytics (DAO2702 or DSC2008 or CS1010 or CS1101) or the equivalent.

COURSE MATERIALS

1. **Readings** (see the list of pre-readings and exercises in the course schedule below).
2. **DataCamp resources**
3. **Class presentation slides** will be available on LumiNUS. Please note that the materials do not comprise self-contained lectures. The **pre-class readings and activities** are an essential part of the class. Please go through them before class, so that you can contribute meaningfully to the class discussions.
4. **Selected articles** from academic finance journals and periodicals (WSJ, Economist, etc.) may be shared directly on the weekly channels on **Microsoft Teams**.
5. **Projects** (see team deliverables below).
6. **Team homework** (including those that are not part of the graded assignments) are essential as they prepare you for projects and quizzes.

TECHNICAL ON-BOARDING

Platform/Tool	Purpose
LumiNUS	LumiNUS is the platform for formal communications and distribution of course materials .
Microsoft Teams	Microsoft Teams is the platform for informal communications, team collaboration, sharing, discussions, and submission of projects and team homework for this course. Your activities here (e.g., sharing class notes, supporting a point of view with facts, challenging a point of view, synthesizing new ideas or arguments, troubleshooting your peers' technical problem, encouraging class discussion with thought-provoking insights/articles) count towards class participation .
Zoom	Zoom is a class delivery tool for live classes for on- and off-site students . Recordings are available on LumiNUS for review after class. Your activities here (e.g., Q&As) count towards class participation . I strongly recommend you turn the video on during classes.
Poll Everywhere	Poll Everywhere is a tool for our live classes . Please register an account with your NUS credential . Your activities (e.g., Q&As, polls) here count towards class participation and class attendance .
Miro	Miro is a visual collaboration workplace. You will receive an invitation to join Miro before the course starts.
Kaggle/Anaconda	We will use Python Jupyter notebooks, which consist of a series of cells, where each cell is either a Markdown (text) or a code. The Kaggle notebooks run in the cloud. You can also use Anaconda data science toolkit or other IDEs.
DataCamp for the Classroom	<p>This is a supplementary platform for self-paced learning. If you complete the recommended DataCamp Skill Tracks (Finance Fundamentals and Applied Finance), you will receive statements of accomplishment from DataCamp. You will receive an invitation to join DataCamp before the course starts.</p> <ol style="list-style-type: none"> 1. You can tailor your learning journey according to your needs. These Skill Tracks prepare you for the Bootcamps and tests. Also, the rewards for your effort are statements of accomplishment from DataCamp. 2. This class is supported by DataCamp, the most intuitive learning platform for data science. Learn R, Python, and SQL the way you learn best through a combination of short expert videos and hands-on-the-keyboard exercises. Take over 100+ courses by expert instructors on topics such as importing data, data visualization, or machine learning and learn faster through immediate and personalized feedback on every exercise. 3. Spread the word about DataCamp's initiative to spread data science education around the world by sharing your DataCamp for the Classroom use and activities on social media (LinkedIn, Twitter, etc.).

ASSESSMENTS

Component	Weight
Team Deliverables	
a) Project 1: TBA (due and presented on Week7)	10%
b) Project 2: TBA (due and presented on Week 13)	10%
c) Team Homework (Problem Sets, Case Studies)	20%
Quiz 1: TBA (Week 6)	20%
Quiz 2: TBA (Week 12)	30%
Class Participation and Citizenship	10%
Total	100%

Grades will be assigned based on the class distribution of the course's total scores. The grade cutoff points will be adjusted based on the class's overall performance.

A. Team Deliverables

Teams of 3-4 participants will prepare the project reports and a series of team homework. Individual submissions are **not** accepted. The details for each project will be released during the term. The project reports should not exceed five double-spaced pages of **text**. This page limitation intends to enforce careful and concise writing. The grading rubrics will be provided.

The five-page limitation does not include **figures and exhibits**; please include those as you deem necessary to convince (but not confuse) the reader. Your response should be consistent with and supported by your main analysis. Please submit the project reports (and supporting documents) to **LumiNUS by 2359 the day before the due date**. While each group will submit only one report for the group, **all students must come fully prepared to present their solutions to the rest of the class**. Each group should share the short presentation file with the instructor on Microsoft Teams (i.e., private chatroom for the group) before the class session. **I may randomly select some groups to present their work during the class discussion**. The whole group will be penalized if the presentation is longer than **10 minutes**, is unclear, or does not match the group's project report. I may interrupt the presentation to clarify certain issues or correct contents in the interest of the class. As I may **randomly select a group member** to present the group's slide deck, I highly recommend each group member practice the presentation to improve clarity and ensure that they meet the time constraint.

Grading of the projects and team homework will be based on the accuracy and novelty of the analytical analysis and on exposition and presentation of findings. I will conduct **group evaluation surveys** after the submissions of project reports. Please contribute actively to the team. If your teammates make it clear that you did not do so, your grade may be adversely affected.

B. Quizzes

There will be two **in-class** quizzes in Week 6 and Week 12. The quiz format will likely be a combination of multiple-choice questions, true-false questions, fill-in-the-blank questions, extensive numerical problems, and essay-type questions. These questions will be designed to test your knowledge of conceptual and qualitative material, as well as your analytical and problem-solving skills. The **second quiz** will be **cumulative** but will emphasize topics covered after the first quiz.

C. Class Participation and Citizenship

I will observe student participation in the course (e.g., classroom, Microsoft Teams, Zoom, Poll Everywhere) and reward students who make a substantial effort. Simply attending classes is a necessary condition, but **not sufficient** to receive a favorable class participation grade. In evaluating class participation, I will look for

comments that are thoughtful and lead the class discussion forward. My evaluation will be based on how well you have participated in class (i.e., consistency and quality of your participation). There is nonetheless no downside to wrong answers. You can improve your participation grade considerably by coming to class prepared. Participation points are awarded **at my discretion** and are based solely on **my opinion** of your efforts and your contribution to class discussions. These points are not automatically given but must be earned. They are not **subject to negotiation**.

OFFICE HOURS

My office hour is Wednesday 1400-1500. To ensure that I am available, please direct message me on Microsoft Teams.

CLASS POLICIES

A. Attendance

Our class discussions will go beyond the scope of the textbook for most topics. Therefore, you need to attend class. You are responsible for all announcements made in class. If you are unable to attend a particular class, please notify the professor of your absence **before** that class. Failure to notify the professor of absence, or missing more than **two sessions** during the course, might result in a failing grade. For an excused absence, the make-up for missed work will be determined by the professor in consultation with the student.

B. Tablets, PDAs, Phones

Please be respectful of others in your usage of electronic devices and wireless communication. By taking this class, you agree to be bound by the following policies:

1. **Mobile phones** need to be shut off or set to silent mode during the class session. No telephone calls, SMS/MMS messages, e-mails and/or chats during class. Upon violation of this policy, you will be asked to put your mobile device on the table in off mode and FACE DOWN. You may also be asked to deposit your devices in a designated area in the classroom.
2. **Laptops and tablets** are restricted to note-taking, Poll Everywhere, and Zoom use only. The use of these devices for chat sessions, checking/answering e-mails, and web surfing is prohibited. I will announce exceptions to the policy for class sessions with course-related content on the web.
3. Violation of the policies can lower the class citizenship component of the course grade above.

ACADEMIC HONESTY & PLAGIARISM

Academic integrity and honesty is essential for the pursuit and acquisition of knowledge. The University and School expect every student to uphold academic integrity & honesty at all times. Academic dishonesty is any misrepresentation with the intent to deceive, or failure to acknowledge the source, or falsification of information, or inaccuracy of statements, or cheating at examinations/tests, or inappropriate use of resources.

Plagiarism is 'the practice of taking someone else's work or ideas and passing them off as one's own' (The New Oxford Dictionary of English). The University and School will not condone plagiarism. Students should adopt this rule - You have the obligation to make clear to the assessor which is your own work, and which is the work of others. Otherwise, your assessor is entitled to assume that everything being presented for assessment is being presented as entirely your own work. This is a minimum standard. **In case of any doubts, you should consult your instructor.**

1. Additional guidance is available [HERE](#).
2. Online Module on Plagiarism [HERE](#).

TENTATIVE COURSE SCHEDULE [Subject to Change]

This is an approximate schedule of topics that will be covered. The assigned pre-reading/exercise will provide the framework for classroom discussions. All readings/exercises (📖 🎮 📄) are required. Please go through them before the corresponding class. Recommended readings will be assigned throughout the course. Adjustments might be made during the course if the pace is faster/slower than expected. (# denotes public holidays, alternative arrangement TBA)

Session	Week	Date	Topics	Pre-Reading/Exercise	Homework
Course Overview & Disruption Theory	1	11 Jan	1. Disruption theory. 2. The drivers of fintech developments.	1. Clayton M. Christensen, Michael E. Raynor, and Rory McDonald. "What is disruptive innovation?" Harvard Business Review (2015). 📖 2. Jim McKelvey. "Good entrepreneurs don't set out to disrupt," Harvard Business Review (2020). 📖	Ant Financial Case Study
Efficient Market Hypothesis	2	18 Jan	1. Random walk hypothesis. 2. The different types of EMH and their respective tests. 3. Lo and Mackinlay (1988) variance ratio test.	1. Case Study: Ant Financial (A) HBS Case 9-617-060. 2. Michael T. Maloney, and J. Harold Mulherin. "The complexity of price discovery in an efficient market: the stock market reaction to the Challenger crash," Journal of Corporate Finance, 9 (2003): 453-479. 📖 3. Andrew W. Lo, A. Craig MacKinlay. "Stock Market Prices Do Not Follow Random Walks: Evidence from a Simple Specification Test," The Review of Financial Studies, 1 (1988): 41-66. 📖 4. Klaus Grobys, Shaker Ahmed, Niranjana Sapkota. "Technical Trading Rules in the Cryptocurrency Market," Finance Research Letters, 32 (2020). 📖	
Behavioral Finance	3	25 Jan	1. Behavioral finance theories. 2. The Shiller (1984) framework. 3. De Bondt and Thaler (1985) overreaction hypothesis.	1. Robert J. Shiller, "Stock Prices and Social Dynamics," Brookings Papers on Economic Activity, 2 (1984): 457-498. 📖 2. Werner F. M. De Bondt, and Richard Thaler. "Does the Stock Market Overreact?" The Journal of Finance 40, 3 (1985): 793-805. 📖 3. Nicky Case. "The Wisdom and/or Madness of Crowds." 🎮	Problem Set on EMH and Behavioral Finance.
Event Studies	4	#1 Feb	1. Ball and Brown (1968) event study methodology. 2. The relationship between event studies, efficient market hypothesis, and behavioral finance. 3. Testing underreaction hypothesis.	1. Ray Ball and Philip Brown. "An Empirical Evaluation of Accounting Income Numbers." Journal of Accounting Research, 6 (1968): 159-178. 📖 2. Louis Ederington, Jeremy Goh, Yen Teik Lee, Lisa (Zongfei) Yang. "Are Bond Ratings Informative? Evidence from Regulatory Regime Changes," The Journal of Fixed Income, 29 (2019): 6-19. 📖 3. Quoc-Anh Do, Yen Teik Lee, Bang D. Nguyen, and Kieu-Trang Nguyen. "Power, Scrutiny, and Congressmen's Favoritism for Friends' Firms," Working Paper (2020). 📖	
Monte Carlo Simulation	5	8 Feb	1. The mechanism behind Monte Carlo simulation. 2. Monte Carlo in capital budgeting decision. 3. Calculating option prices and optimal portfolio weights.	1. John Rozycki. "Excel-Based Monte Carlo Simulation as a Capital Budgeting Risk Management Tool." Journal of Financial Education, 37 (2011): 101-128. 📖 2. Fischer Black and Myron Scholes. "The Pricing of Options and Corporate Liabilities." Journal of Political Economy, 81 (1973): 637-654. 📖 3. Ian Xiao. "CMO Lab: Nike Marketing." 🎮	Problem Set on Event Studies and Monte Carlo Simulation.
Quiz 1, Brainstorm	6	15 Feb	1. Quiz 1 2. Project 1 Mentorship		
RECESS WEEK					

Session	Week	Date	Topic	Pre-Reading/Exercise	Homework
Project 1, External Speaker	7	1 Mar	1. Project 1 Presentation. <i>External speaker.</i>		CredEx Fintech Case Study
Real option, Digitalization	8	8 Mar	1. The real options framework. 2. Digital transformation.	1. Case Study: CredEx Fintech. 2. Keith Leslie and Max Michaels. "The real power of real options," McKinsey Quarterly (2000). [E] 3. Alexander B. van Putten and Ian MacMillan. "Making Real Options Really Work," Harvard Business Review (2004). [E] 4. Behnam Tabrizi, Ed Lam, Kirk Girard, and Vernon Irvin. "Digital Transformation Is Not About Technology," Harvard Business Review (2019). [E]	
AI in Finance	9	15 Mar	1. Supervised, unsupervised, and semi-supervised ML. 2. Machine, reinforcement, and deep learning. 3. Natural Language Processing	1. Machine learning for finance in Python. [V] 2. Matthew F. Dixon and Igor Halperin. "The Four Horsemen of Machine Learning in Finance," Working Paper (2019). [E] 3. Building the AI Bank of the Future. "Building the AI Bank of the Future," McKinsey & Company, Global Banking Practice (2021). [E] 4. Introduction to Natural Language Processing. [V]	Ripple Case Study
Digital Payments	10	22 Mar	1. The mechanism behind within and across border payments.	1. Case Study: Ripple 2. Antony Lewis (Money, Digital Money). 3. Marion Laboure and Jim Reid. "Part I. Cash: The Dinosaur Will Survive ... For Now," Deutsche Bank Research (2020). [E] 4. Marion Laboure and Jim Reid. "Part II. Moving to Digital Wallets and the Extinction of Plastic Cards," Deutsche Bank Research (2020). [E] 5. Marion Laboure and Jim Reid. "Part III. Digital Currencies: The Ultimate Hard Power Tool," Deutsche Bank Research (2020). [E]	
Cryptography and Cybersecurity, Blockchain in Finance	11	29 Mar	1. The mechanism behind cryptography. 2. Cybersecurity and cryptographic techniques. 3. The mechanism behind blockchain. 4. The use cases of blockchain in finance (Web 3.0, DeFi, DAO, NFT, Metaverse)	1. Antony Lewis (Cryptography, Cryptocurrencies, Blockchain Technology). 2. Xin Deng, Yen Teik Lee, and Zhengting Zhong. "Decrypting Coin Winners: Disclosure Quality, Governance Mechanism and Team Networks," Working Paper (2018). [E] 3. Campbell R. Harvey, Ashwin Ramachandran, and Joey Santoro. "DeFi and the Future of Finance," Working Paper (2021). 4. Herman Narula. "Herman Narula on why the metaverse matters," The Economist (2021). [E] 5. Fabrice Ventures. "What is Web 3.0 & Why It Matters," Medium (2020). [E]	
Quiz 2, Brainstorm	12	5 Apr	1. Quiz 2 2. Project 2 Mentorship		
Project 2	13	12 Apr	1. Project 2 Presentation		

Note 1: The default delivery plan is face-to-face instruction for all students with live Zoom streaming (for those who are symptomatic or living in extraordinary circumstances). With the ongoing COVID-19 pandemic, there are contingency plans for face-to-face and virtual instruction alternatives if policies and guidelines change during the semester. Stay tuned to LumiNUS and Microsoft Teams announcements.


Note 2: The digital Harvard Business Review articles are accessible via Business Source Premier at the library.

Note 3: Antony Lewis. "The Basics of Bitcoins and Blockchains," Mango Publishing (2018). ISBN 9781633538009.

ACKNOWLEDGMENTS

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1. Ideas and inspirations

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2. Learning and platforms

DataCamp for Classrooms 

WRDS for Classroom 