FIN4719 FINTECH AND FINANCIAL DATA ANALYTICS

AY2022/23 Semester 2

Class Meetings: BIZ1 2-2; Tuesday 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). Students are not required to code most algorithms from scratch but use ready codebase (i.e., coding Bootcamps) and the state-of-the-art open-source libraries.

Each student should regularly contribute to classroom discussion in person (e.g., lectures, fireside chats, assignments) **or on Canvas** (e.g., post-class reflections, food for thought, peer review of assignments). 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 tests. 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

Students should be comfortable with tools for the analysis of data; familiarity with programming languages, like Python, will be needed. Students 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 on Canvas).
2. **DataCamp resources**
3. **Class presentation decks** will be available on Canvas. 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.) are shared directly on Canvas.
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 tests.

TECHNICAL ON-BOARDING

Platform/Tool	Purpose
Canvas	Canvas is the platform for **formal announcements,** distribution of **course materials, informal communications, team collaboration, sharing, discussions,** and **submission** of team assignments and individual deliverables. Your **activities** here (e.g., post-class reflections, food for thought, peer review of assignments) count towards **class participation**.
Poll Everywhere	Poll Everywhere is a tool for **class activities**. Please register an account with your **NUS credential**.
Jupyter Notebook	Python Jupyter notebooks consist of a series of cells, where each cell is either a Markdown (text) or a code. You can use any local IDEs (e.g., Ananconda data science toolkit) or cloud-based Kaggle/Deepnote/Colab to run the notebooks.
DataCamp for the Classroom	This is a **supplementary platform for self-paced learning**. You can tailor your learning journey according to your needs.[1]

ASSESSMENTS

Component	Weight
Team Deliverables	
a) Final Project: TBA (due and presented on Week 13)	20%
b) Team Homework (Problem Sets, Case Studies)	20%
Test 1: TBA (Week 6)	20%
Test 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.

[1] 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. 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.).

A. Team Deliverables

Teams of maximum 6 participants will prepare the project reports and a series of team homework. 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 is available on Canvas.

The five-page limitation does not include **figures and exhibits**; please include those as you deem necessary to convince the reader. Your response should be consistent with and supported by your main analysis. Please submit the project reports (and supporting documents) to Canvas. While each group will submit only one report for the group, **all teammates must come fully prepared to present their solutions to the rest of the class**. **I may randomly select some groups to present their work during the class discussion**. Please stay within the stipulated presentation time. Otherwise, a penalty may apply. I highly recommend each group member practice the presentation to improve clarity and ensure that they meet the stipulated 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 survey** after the submissions of project report. 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. Tests

There will be two **in-class** tests in Week 6 and Week 12. The test format will likely be a combination of multiple-choice questions, true-false questions, fill-in-the-blank questions, 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. You may be required to write pseudocode, but not Python code, to execute an algorithm. The **second test** will be **cumulative** but will emphasize topics covered after the first test.

C. Class Participation and Citizenship

I will observe student participation in the course (e.g., classroom, Canvas) 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**.

CLASS POLICIES

A. Attendance

Your presence is essential for everyone's success. You are allowed to miss two class meetings. Any further absence is likely to affect your engagement with the class content and ideas discussed in class. If you are unable to attend a particular class meeting, please be proactive, notify me of your absence ***before*** that class. For an excused absence, the make-up for missed work will be determined by me in consultation with you. Failure to notify me of your absence or a prolonged absence for any reason may adversely affect your grade.

B. Tablets, PDAs, Phones

Electronic devices are welcome in class to support your learning. However, please be mindful that they do not distract you or those around you.

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

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.

Session	Week	Date	Topics	Resources	Homework
Course Overview, Disruption Theory, Platform Economics, Refinitiv Overview	1	01/10	1.Disruption theory. 2.The drivers of fintech developments. 3.Platform economics.	1. Clayton M. Christensen, Michael E. Raynor, and Rory McDonald. "What is disruptive innovation?" Harvard Business Review (2015). 2. Feng Zhu and Marco Iansiti. "Why Some Platforms Thrive and Others Don't," Harvard Business Review (2019).	Ant Financial Case Study
Efficient Market Hypothesis	2	01/17	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). 2. 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. 3. *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. 4. *Klaus Grobys, Shaker Ahmed, Niranjan Sapkota. "Technical Trading Rules in the Cryptocurrency Market," Finance Research Letters, 32 (2020).	
Behavioral Finance, Fireside Chat (TBC)	3	#01/24	1.Behavioral finance theories. 2.The Shiller (1984) framework. 3.De Bondt and Thaler (1985) overreaction hypothesis.	1. Werner F. M. De Bondt, and Richard Thaler. "Does the Stock Market Overreact?" The Journal of Finance 40, 3 (1985): 793-805. 2. Nicky Case. "The Wisdom and/or Madness of Crowds." 3. *Robert J. Shiller, "Stock Prices and Social Dynamics," Brookings Papers on Economic Activity, 2 (1984): 457–498.	Problem Set on EMH and Behavioral Finance.
Event Studies	4	01/31	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	02/07	1.The mechanism behind Monte Carlo simulation. 2.Monte Carlo in capital budgeting decision. 3.Calculating option prices and optimal portfolio weights.	1. Ian Xiao. "CMO Lab: Nike Marketing." 2. *Fischer Black and Myron Scholes. "The Pricing of Options and Corporate Liabilities." Journal of Political Economy, 81 (1973): 637–654.	Problem Set on Event Studies and Monte Carlo Simulation.
Test 1, Final Project Mentorship	6	02/14	1.Test 1 2.Final Project Mentorship		
RECESS WEEK					

Session	Week	Date	Topic	Pre-Reading/Exercise	Homework
AI in Finance	7	02/28	1. Supervised, unsupervised, and semi-supervised ML. 2. Machine, reinforcement, and deep learning. 3.Natural Language Processing. 4.Ethical AI in finance.	1. Machine learning for finance in Python. 2. Francois Candelon, Rodolphe Charme di Carlo, Midas De Bondt, Theodoros Evgeniou. "AI Regulation is Coming," Harvard Business Review (2021). 3. OpenAI's GPT3. 4. *Introduction to Natural Language Processing.	CredEx Fintech Case Study
Real option, Digitalization in Finance, Fireside Chat (TBC)	8	03/07	1. Fireside chat. 2. The real options framework. 3. Digital transformation.	1. Alexander B. van Putten and Ian MacMilllan. "Making Real Options Really Work," Harvard Business Review (2004). 2. Behnam Tabrizi, Ed Lam, Kirk Girard, and Vernon Irvin. "Digital Transformation Is Not About Technology," Harvard Business Review (2019). *Keith Leslie and Max Michaels. "The real power of real options," McKinsey Quarterly (2000).	
Digital Payments	9	03/14	1.The mechanism behind within and across border payments.	1. Case Study: CredEx Fintech 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). 4. *Marion Laboure and Jim Reid. "Part II. Moving to Digital Wallets and the Extinction of Plastic Cards," Deutsche Bank Research (2020). 5. *Marion Laboure and Jim Reid. "Part III. Digital Currencies: The Ultimate Hard Power Tool," Deutsche Bank Research (2020).	Ripple Case Study
Cryptography and Cybersecurity	10	03/21	1.The mechanism behind cryptography. 2.Cybersecurity and cryptographic techniques.	1. Case Study: Ripple 2. Antony Lewis (Cryptography, Cryptocurrencies, Blockchain Technology).	
Blockchain in Finance, Fireside Chat (TBC)	11	03/28	1. The mechanism behind blockchain. 2. The use cases of blockchain in finance (Web 3.0, DeFi, DAO, NFT, Metaverse)	1. Antony Lewis (Cryptography, Cryptocurrencies, Blockchain Technology). 2. Campbell R. Harvey, Ashwin Ramachandran, and Joey Santoro. "DeFi and the Future of Finance," Working Paper (2021). 3. *Xin Deng, Yen Teik Lee, and Zhengting Zhong. "Initial Coin Offerings and Team Networks," Working Paper (201). 4. *Herman Narula. "Herman Narula on why the metaverse matters," The Economist (2021). 5. *Fabrice Ventures. "What is Web 3.0 & Why It Matters," Medium (2020).	
Test 2, Project Mentorship	12	04/04	1.Test 2 2.Final Project Mentorship		
Final Project	13	11/04	1.Final Project Presentation		

***** *Optional; # Public holiday, replacement class TBC.*

Note 1: The default delivery plan is face-to-face instruction for all students. 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 Canvas for 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.

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