

FIN4719 FINTECH AND FINANCIAL DATA ANALYTICS

AY2023/24 Semester 2

Class Meetings: BIZ2-B104; Tuesday 1200-1500

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Office Hours: Tuesday 1500 to 1600 and by appointment

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 (AI) and generative AI, (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 will leverage generative AI to develop solutions.

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 pre-class readings in the course schedule below). Selected articles from academic finance journals and periodicals (WSJ, Economist, etc.) may be shared directly on Canvas.
2. **Class presentation slides** will be available on Canvas. Please note that the slides are not self-contained. The **readings and activities** are an essential part of the class. Please go through them so that you can contribute meaningfully to the class discussions.

ASSESSMENTS

Component	Weight
Group Final Project	30%
Test 1	20%
Test 2	30%
Class Participation and Citizenship	20%
Total	100%

A. Group Final Project

You will prepare the final project report with your group. The details, including the grading rubrics, for the project will be available on Canvas. The project report should not exceed five double-spaced pages of **text**. This page limitation intends to enforce careful and concise writing. The five-page limitation does not include **figures and exhibits**; please include those as you deem necessary to convince the reader. Please stay within the stipulated presentation time. Otherwise, a penalty may apply. You will write a **peer evaluation** at the end-of-term. 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, 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 test** will be **cumulative** but will emphasize topics covered after the first test.

C. Class Participation and Citizenship

Class attendance is a necessary but **not sufficient** condition to receive a favorable class participation grade. The consistency and quality of your participation matter. You are expected to contribute **at least once a week**, either in class or on Canvas (i.e., one contribution – discussion, answering case or problem set discussion). I will reward anyone who goes the extra mile (e.g., insightful and thoughtful comments that lead the class discussion forward) in the classroom and on Canvas (e.g., Canvas discussions, assignments, peer reviews) with **FinCoin**. 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 must be earned. They are not **subject to negotiation**. You will write **self-evaluations** at the midterm and end-of-term.

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 (i.e., missing two class sessions), 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.

Artificial Intelligence (AI) tools such as ChatGPT do not require specialist knowledge to use. Many of these AI tools are commonly used in social media, for example, to create content and disguise and refine content created from programmes like ChatGPT. We understand that students will be drawn to using these AI Tools, as they would for any other electronic aid.

However, to be clear, normal academic rules still apply. As noted in the Code of Student Conduct: "The University takes a strict view of cheating in any form, deceptive fabrication, plagiarism and violation of intellectual property and copyright laws. Any student who is found to have engaged in such misconduct is subject to disciplinary action by the University."

With respect to AI tools (e.g., ChatGPT and image generation tools), your instructor will clarify whether the use of these tools as inputs into your assignment development process is acceptable. AI is a technology that requires skill to use, and knowledge about when and how to use it. If you use ChatGPT or any other such AI tool in your work, you must provide a proper representation of how you used the tool and what prompts you used to generate output. Failure to cite its use constitutes academic misconduct.

Further, as with any information source, be aware that minimal efforts yield low quality results. You will need to refine your work and fact-check the output, as you would double-check information from any source. Further, you should be selective in how and when you use such tools instead of using it for each and every assignment you create.

To summarise:

1. Always check with your instructors on what are the permitted uses of AI tools.
2. Have a discussion at the start of a course about the use of AI.
3. Where permitted, acknowledge your use of AI.
4. You remain responsible for the quality of your work and its appropriate representation.
5. Failure to follow the above steps can lead to a concern about plagiarism (academic dishonesty).

As always, 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 entirely your own work. This is a minimum standard.

Additional guidance can be found at:

Admission Condition: [📄](#)

NUS Code of Student Conduct: [📄](#)

Academic Integrity Essentials: [📄](#)

Guidelines on the Use of AI Tools For Academic Work: [📄](#)

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
Course Overview, Disruption Theory, Platform Economics	1	01/16	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). 📖
Efficient Market Hypothesis	2	01/23	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	01/30	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. 📖
Event Studies	4	02/06	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	02/13	1. The mechanism behind Monte Carlo simulation. 2. Monte Carlo in capital budgeting decision. 3. Calculating option prices and optimal portfolio weights.	1. *Fischer Black and Myron Scholes. "The Pricing of Options and Corporate Liabilities." Journal of Political Economy, 81 (1973): 637–654. 📖
Test 1, Final Project Mentorship	6	02/20	1. Test 1 2. Final Project Mentorship	
RECESS WEEK				

Session	Week	Date	Topic	Pre-Reading/Exercise
AI in Finance	7	03/05	<ol style="list-style-type: none"> 1. Machine, reinforcement, and deep learning. 2. Ethical AI in finance. 3. Generative AI. 	<ol style="list-style-type: none"> 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. *Introduction to Natural Language Processing. 📄
Real option, Digitalization in Finance, Fireside Chat (TBC)	8	03/12	<ol style="list-style-type: none"> 1. Fireside chat. 2. The real options framework. 3. Digital transformation. 	<ol style="list-style-type: none"> 1. Alexander B. van Putten and Ian MacMillan. "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). 📄 3. *Keith Leslie and Max Michaels. "The real power of real options," McKinsey Quarterly (2000). 📄
Digital Payments	9	03/19	<ol style="list-style-type: none"> 1. The mechanism behind within and across border payments. 	<ol style="list-style-type: none"> 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). 📄
Cryptography and Cybersecurity	10	03/26	<ol style="list-style-type: none"> 1. The mechanism behind cryptography. 2. Cybersecurity and cryptographic techniques. 	<ol style="list-style-type: none"> 1. Case Study: Ripple 2. Antony Lewis (Cryptography, Cryptocurrencies, Blockchain Technology).
Blockchain in Finance, Fireside Chat (TBC)	11	04/02	<ol style="list-style-type: none"> 1. The mechanism behind blockchain. 2. The use cases of blockchain in finance (Web 3.0, DeFi, DAO, NFT, Metaverse) 	<ol style="list-style-type: none"> 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	04/09	<ol style="list-style-type: none"> 1. Test 2 2. Final Project Mentorship 	
Final Project	13	04/16	<ol style="list-style-type: none"> 1. Final Project Presentation 	

* Optional; # Public holiday, replacement class TBC.

Note 1: The digital Harvard Business Review articles are accessible via Business Source Premier at the library.

Note 2: Antony Lewis. "The Basics of Bitcoins and Blockchains," Mango Publishing (2018). ISBN 9781633538009.

PROFILE OF INSTRUCTOR




Lee Yen Teik is a Senior Lecturer at NUS Business School. He is a teacher, researcher, and mentor in corporate and digital finance. Before joining NUS, Yen Teik was an Assistant Professor of Finance at the Asia School of Business and Shanghai University of Finance and Economics (SUFE), a Senior Lecturer at Curtin Singapore, and a visiting scholar at both New York University Stern School of Business and Cambridge Judge Business School. He is the recipient of the Society of Financial Studies Finance Cavalcade Best Paper in Corporate Finance Award 2013 and the SUFE Excellent Teachers Award 2015. His works have been featured on Kellogg Insight, BBC World Service, The Economist (blog), and The Columbia Law School (Blue Sky Blog), as well as published in the Journal of Corporate Finance, the Journal of Fixed Income, and the Journal of Accounting and Public Policy, among others. Yen Teik received his PhD in Business (Finance) from Singapore Management University.

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