Shahjalal University of Science and Technology, Bangladesh.
DEPARTMENT OF ECONOMICS

ECO528; spring2023
Financial Economics

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A. Course description

This course is designed to provide a basic theoretical knowledge of financial economics and finance, modern portfolio theories, and their applications to asset pricing, portfolio investments, and risk management. At the same time, we aim to apply necessary mathematics, statistics, and programming skills, as is regularly common in computational finance courses, and focus on real applications of modern portfolio theory. We begin with the fundamental concepts of finance, economics, financial assets, theories in asset pricing, and statistical properties of financial data. Then, we consecutively progress toward using quantitative tools to analyze financial data and make portfolio decisions. We will covervarious financial instruments (traditional and digital assets), blockchain technology, cryptocurrencies, Real Estate Investment Trust (REITs) and how to use them for investment or hedging purposes. Throughout the course, the software R will be introduced and heavily used via examples and simulations so that students can gain real experience with financial markets and understand how investment decisions in portfolio markets are made using various econometric/machine learning methods. Particular attention will be given to FinTech, DiFi, time series models, REITs stocks, and computational skills (an essential skill for quant finance) in explaining and visualizing financial data and practical implementation of asset pricing and risk models. Finally, each week's empirical assignments will be designed to prepare students for their careers in the financial industry and to prepare them to write their capstone/research paper in finance.

B. Prerequisites

Prerequisites of this course include solid understanding in intermediate microeconomics and macroeconomics, college-level calculus, statistics and probability theory, and linear algebra. Previous programming skills are not required; however, a familiarity of beginner-level computer programming (C++/R/Python/Julia) is expected.

C. Course Learning Outcomes (CLOs)

On successful completion of this course students are expected to:
1. Familiarwith the fundamental theorem of finance, financial markets, principles of asset pricing, and risk management.

2. Get an introduction to the modeling techniques for asset pricing, find the optimal portfolio by applying mean-variance and capital asset pricing model (CPAM) analysis, and know how to form and diversify portfolios of assets.
3. Know the notion of risk premium and models characterizing equilibrium risk premiums, bring finance theory into practice using real data and R-programming, find fair prices of financial assets, and make investment decisionsin a dynamic setting.
4. Apply representative agent analysis to solve a simple portfolio choice problem and determine equilibrium expected returns
5. Get industry-level understanding of derivative markets, hedging, fintech, blockchain, digital assets, real estate finance and stocks that affect investor's portfolio construction.

D. Teaching and assessment

D1. Teaching and learning modes

Lecture: 2 sessions/ week, 120minutes / session

Meeting/Class Time: TUE & WED; 2:00 – 4.00pm; **Classroom: 4001 (Academic Building D)**

Office Hours: Wednesday: 10:00 - 12:00pm (or by appointment); **2021 (Academic Building D)**

In person class lectures include two two-hour meetings per week; In addition, we will discuss the solution of homework and quiz during the class meetings; Students are encouraged to work in group for their homework and utilize the office hours to discuss any questions related to homework, quizzes, and class materials with the instructor.

D2. Assessment/Evaluation and Grades

The course follows University's policy on assessment (grading) that is based on the following four criteria:

Activities	Percentage
Midterm exam 1& 2	20
Final exam	60
Class attendance	10
Class test/quiz	5
Homework (5 assignments)	5

Exams

There will be two mid-semester tests and a final exam. The first midterm will be on Wednesday, March 8, and the second midterm will be on May 23, 2023. The midterm dates are tentative. Depending on our pace in the course, I may change the dates in the future. The averagescore of the two mid-semester exams willbe counted as your final midtermscore. ***Please, there will be no make-up mid-semester exam unless you have proof of medical emergency or similar issues.*** The final exam will cover the entire course materials, and the date of the final exam will be announced in due course by the department.

Quizzes

The quizzes are comprehensive (Short questions and mostly quantitative in nature; 20 minutes) in-class surprise tests. They will be given at the start/end of class; thus, you will have less time to complete the quiz if you are late/leave classes early.

Homework/Problem sets
The problem sets will ask you to solve asset pricing models and their empirical examinations using historical data, and present intuitive analysis, solving computational problems using class notes. There will be 4or 5 problem sets. The grades you get from the homework may be included as of 10% of your course grades in case your performance in the quizzes is not satisfactory. Moreover, doing and submitting your homework will be very helpful for your exams.

Class attendance
Class attendance is mandatory and will count 10% of your final grade.

D3. Assessment of course learning outcomes

Outcomes	Quiz/in-class test	Mid-semester exams	Homework/ assignment	Class participation	Final examination
CLO-1	**X**		**X**	**X**	**X**
CLO-2	**X**	**X**	**X**	**X**	**X**
CLO-3	**X**	**X**	**X**	**X**	**X**
CLO-4	**X**	**X**	**X**	**X**	**X**
CLO-5	**X**		**X**	**X**	**X**

D4. Expected workload
The information below is provided as a guide to assist students in engaging appropriately with financial economics course requirements.
Total: 10 hours per week.
Self-study: 4 hours per week; Lectures: 4 hours; Homework: 2 hours
Personal study (including solving homework/problem sets, exploring financial data using R, and reading required class materials). When I ask you to read some chapter/material from the text and related papers in advance of a lecture, please put your best effort into doing it. Please remember, reading means going through the class lectures, online materials (tons of materials are available there) with a pencil and an ample supply ofpaper next to you. I expectyou to re-do (or do in advance) all the mathematical derivations and R-scripts as you read through those materials. Finally, the most important point: **Please do not try tomemorize any of the material**. You must focus on understanding all the equations, results and their applications in real world investment decisions and financial industries.

E. Course content and lecture schedule

LECTURE OUTLINE

Week	Lecture	Topic	Readings
Week1	Lec1	Financial economics, Finance and Financial engineering; Asset class: Bonds, Stocks, and commodities, Fintech: Cryptocurrencies, DeFi, NFTs, REITs, Options and other derivatives; Trading positions.	B1, B2 & B5
Week1	Lec2	Asset prices and returns; Return on a portfolio; Investor's portfolio: long and short positions; Short sales; Historical perspective on the financial modeling of the equity market.	B1 & B8 (Ch1)

Week2	Lec3	Mean-Variance Portfolio Analysis: The Markowitz Model Efficient portfolios and efficient frontier; Solution to the Markowitz optimization problem; Properties of efficient portfolios; Mean and variance of the return on an efficient Week1portfolio.	B1, B2 & B3
Week2	Lec4	A fund separation theorem; The Markowitz model with a risk-free and risky asset; Portfolio optimization with a risk-free and risky asset; Efficient portfolios in a market with a risk-free and risky asset; Expectations and variances of portfolio returns; Efficient frontier and the capital market line; Tangency portfolio; A mutual fund theorem.	B1, B2 & B3
Week3	Lec5	Industry techniques and applications for calculating the efficient frontier; short sales are allowed and riskless lending and borrowing is possible; short sales are allowed but riskless lending or borrowing is not permitted; short sales are disallowed but riskless lending and borrowing exists; neither short sales nor riskless lending and borrowing is allowed	B7 (ch6)
Week3	Lec6	Capital Asset Pricing Model (CAPM); An Equilibrium Approach to the CAPM; The Sharpe-Lintner-Mossin Formula; Security Market Line and the Pricing Formula; CAPM as a Factor.	B1, B2 & B3
Week4	Lec7	Theorem: foundation of CAPM; Proof of the theorem ; Risk of an asset: standard deviation and beyond; Why it is called "beta" ; Derivation and interpretation of CAPM; Beta estimates.	B1, B2 & B3
Week4	Lec8	Applying Theory to Practice: Sharpe's and Jensen's Tests; Factor Models and the Ross-Huberman Arbitrage Pricing Theory (APT); Single- and Multi-Factor Models; Exact Factor Pricing; Ross-Huberman APT.	B1, B2 & B3
Week 5	Lec9	**Mid-Semester Test 1**	
Week 5	Lec10	R-environment:Time series of financial data, importing stock market data, sources of data in finance/financial economics, Asset Returns; Bond Yields and Prices;	Class notes B8
Week6	Lec11	Volatility and distributions of asset returns, density function and moments, Stationarity and autocovariance; Visualization and summary analysis of financial data in R; R-packages for financial data analysis and investment decisions.	Class notes B8
Week 6	Lec12	The efficient frontier and CAPM simulation using R; Replication: Cochrane's evidence using R;	Class notes B8
Week7	Lec13	Portfolio investment decisions; CAPM- theory vs. reality ; Momentum investing; Small-cap investing Value premium; "Value" measures; Empirics and simulation: Cumulative return; Equally weighted portfolio; Momentum investing ;Value investing; Value premium puzzle; Fama-French's factor model	B1, B2 & B3
Week7	Lec14	Presentation/ showcasing student's best work on portfolio decisions using actual real stock/asset market data	
Week8	Lec15	Random walk hypothesis; Martingale hypothesis; Predictable return formulated; Informational asymmetry and efficiency; Return predictability of dividend yield ; Empirical evidence in	B1, B6 & B7

		R: Return predictability; regression ; Data-mining and spurious regression	
Week8	Lec16	Asset price dynamics without uncertainty; R-simulation: Present value model and Asset price dynamics	B1 & B2
Week9	Lec17	General equilibrium (GE) and representative agent model, Pure-endowment General Equilibrium model; GE model with 2 individuals and 3 goods; R-simulation: How to compute GE and Representative Agent model; Consumption-based Asset Pricing (Non-stochastic)	B1 & B2
Week9	Lec18	GE asset pricing; R-simulation: 10-period model; Volatility puzzle; Robert-Shiller data; R-simulation: Robert-Shiller exercise; Consumption-based Asset Pricing (Stochastic)	B1 & B2
Week10	Lec19	State-contingent goods; The price of an asset as a basket of state-contingent goods; Risk-neutral probability; Utility function for uncertainty; Utility function in the Dynamic Stochastic environment; General equilibrium in the Dynamic Stochastic environment; One-period-ahead state prices; State-prices in units of the date-0 good; One-period-ahead state prices (The stationary case); Stock price as sum of state prices	B1 & B2
Week 10	Lec20	The Lucas Tree Model; Dynamic Stochastic environment (Infinite horizon); Estimating equilibrium prices; One-period-ahead prices derived; Stationary case (2-state case); Stationary case (N-state case).	B1 & B2
Week 11	**Mid-Semester Test II**		
Week11	Lec22	Option Pricing Theory: Calls, Puts, Warrants; Basic characteristics of option values; Minimum Value of a European Call; Early Exercise of an American Call; Put Call Parity; Binomial lattice model, additive and multiplicative model; Binomial Option Pricing; The Black–Scholes Option Valuation	B2 & B7
Week12	Lec23	Derivative Securities: Forwards, futures, and swaps; the Valuation and Uses of Financial Futures; Attributes of Futures Contracts; Profits and Losses from Futures Contracts;	B2 & B7
Week12	Lec24	Treasury Bill Futures; Treasury Bond Futures; Stock Index Futures; Foreign Currency Futures; Hedging; Nonfinancial Futures and Commodity Funds.	B2 & B7
Week13	Lec25	Real Estate Finance: types of real estate, real estate companies, Investment in real estate finance, Mortgage Loan Foundations; Fixed Interest Rate Mortgage Loans; REITs	B9
	Lec26	Online finance; Blockchain and Fintech; DeFi; Digital assets: Cryptocurrencies, NFTs; Potential risk in investing in digital assets; Online trading; Online portfolio selection; The universal online portfolio; Efficient universal online portfolio.	Class notes
Week 14	Lec27	**Review**	
	Final Exam		

-The above course outline is tentative and therefore subject to change during the process.
*: Class notes will be posted on my Github page (https://github.com/masud-alam/FinancialEcon_sust_23) before the lecture.

F. Alignment of course contents with the CLOs

Contents/lectures	CLO-1	CLO-2	CLO-3	CLO-4	CLO-5
Lecture 1 &2	**X**				
Lecture 3-8	**X**	**X**	**X**		
Lecture 9-13		**X**	**X**	**X**	
Lecture 14-20	**X**		**X**	**X**	
Lecture 22-24		**X**		**X**	**X**
Lecture 25		**X**		**X**	**X**
Lecture 26		**X**	**X**	**X**	**X**

G. Textbook

Primary text:

B1. Fabozzi, F. J., Neave, E. H., & Zhou, G. (2011). Financial economics. Wiley Global Education. (FNZ)
B2. Luenberger, D. (2009). Investment science: International edition. OUP Catalogue. (DL)
B3. Evstigneev, I. V., Hens, T., & Schenk-Hoppé, K. R. (2015). Mathematical Financial Economics. (EHS)
B4. Cochrane, J. (2009). Asset pricing: Revised edition. Princeton university press. (COC)

Supporting text:

B5. Bodie, Z., Kane, A., & Marcus, A. (2020). Investments-Global edition. 12th Edition, McGraw Hill. (BKM)
B6. Capinski, M., &Zastawniak, T. (2003). Mathematics for finance: An Introduction to financial engineering. (CZ)
B7. Goetzmann, W. N., Brown, S. J., Gruber, M. J., & Elton, E. J. (2014). Modern portfolio theory and investment analysis. John Wiley & Sons, 237. (GBGE)
B8. Zivot, E. (2017). Introduction to Computational Finance and Financial Econometrics with R. Available at https://bookdown.org/compfinezbook/introFinRbook/
B9. Brueggeman, W. B., & Fisher, J. D. (2018). Real estate finance and investments. New York: McGraw-Hill Irwin.

The course will also cover a few topics from journal articles and working papers. I will deliver copies of those Articles/papers and all other lecture material to the class.

Computational tool: Julia(https://julialang.org/), **R** (available at https://www.r-project.org/)and **R Studio** (https://www.rstudio.com/),

Communication

Our primary means of communication outside the classroom is email (masudalam-eco@sust.edu) and in-person meetings during office hours. Furthermore, I welcome your emails whenever you have any questions.

Classroom courtesy

I count on your judgment and discipline regarding the use of electronic devices in the classroom. Please exercise your discipline and respect other students and the instructor.

Accessibility statement

Any student requiring academic accommodation due to a disability or mental health condition should let his or her faculty member know as soon as possible. In addition, students who need academic accommodations based on the impact of a disability/mental health will be encouraged to contact the department's head and student advisor if they have not done so already.

Student feedback

I value and prioritize interactive approaches to learning and teaching that enhance the student experience. So, I appreciate the feedback from students in various ways, including ongoing engagement in the class, email, and in-person discussion during my office hours. Please, feel free to inform my teaching practice, lectures modes, pace about the course materials, and course curriculum design. Your feedback will support me to assess how effectively I am facilitating the learning environments and delivering course materials that are the key to helping student engagement and learning outcomes.