

FINA 3103: Intermediate Investment

Class Note 1: Introduction

Jun Aoyagi
HKUST

Fall 2026

This Class

What is this class?

- ▶ Investment class for undergrad students

Instructor

- ▶ Jun AOYAGI, giving 80min×25 classes
 - ▶ LSK 5005, junaoyagi@ust.hk
 - ▶ Office hours by appointment
 - ▶ Ph.D., UC Berkeley / BA. & MA., U Tokyo
 - ▶ Research in Market Microstructure and FinTech
 - ▶ Website: [\[here\]](#)

Teaching assistant

- | | |
|--|---------------------------------|
| ▶ Kevin Geng (L3) | ▶ Jing You (L4) |
| ▶ LSK 5F Common Area | ▶ LSK5067 |
| ▶ gengqian@ust.hk | ▶ jyouaf@connect.ust.hk |
| ▶ Office hours: Tue 11:00-12:00
(or by appointment) | ▶ Office hours: Mon 13:00-14:00 |

Class Material

Official class webpage on Canvas:

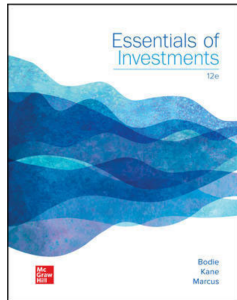
- ▶ <https://canvas.ust.hk/courses/>

Main textbook:

- ▶ Bodie, Kane and Marcus (BKM), “Essentials of Investments”
- ▶ Available at UST library

Class slides (posted on Canvas)

- ▶ Textbook is just for reference



Expected Background

- ▶ Basic knowledge of finance
 - ▶ FINA 2203/2303 (prerequisite)
- ▶ Basic knowledge of statistics
 - ▶ Random variables, expectation, variance and covariance
 - ▶ Sample vs population data
 - ▶ Linear regression (OLS)
- ▶ Basic knowledge of calculus
 - ▶ Taking first-order derivative

Grading

Homework ($\times 4$; 20%)

- ▶ Multiple choice questions
- ▶ Submit your own answers but you can discuss with your friends
- ▶ (Aiming at $>95\%$ on average)

Midterm (Oct 22, 7:30pm; 25%), Final Exams (TBD; 55%)¹

- ▶ MCQ and short-answer questions, covering all materials
- ▶ Closed book but bring an A4 cheatsheet (both sides) with notes that have been prepared by you
- ▶ Calculator (smartphones and other devices are not allowed)
- ▶ (Aiming at $\approx 65\text{-}70\%$)

¹The final is cumulative

Course Rules (refer to the syllabus)

▶ Email:

1. Please contact TAs first if you have inquiries unrelated to the class contents (class recording, logistics, exam/HW arrangements, etc)
2. Please contact the Student Office about the class quota or special assistance in exams
3. Please sign up for the office hour if your question involves lines of equations

▶ Recording will be provided only if students

1. could not attend the class during the add/drop period due to schedule conflicts
2. take sick leave or school-related leave (such as participating in a conference/competition as an official representative of the school)
 - ▶ please submit a formal document (doctor's letter); and
3. will be made available for one week before the midterm and final exams

Course Rules (refer to the syllabus)

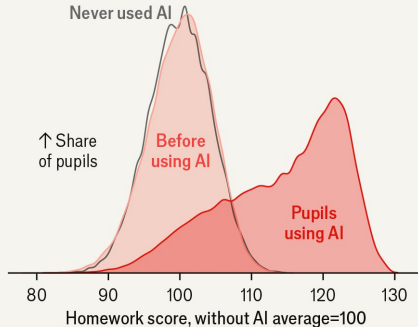
- ▶ Make-ups will NOT be given by default. If there are family or medical emergencies, and prior notice is given, prorations will be done. For the final exam, need to file and go through the formal process via the Student Office.
- ▶ Class attendance is strongly encouraged. Will cover exercise problems very similar to those in exams.
- ▶ Will start class exactly on time. Do not disturb other students in the class.
- ▶ Student Honor Code: any violations will be dealt accordingly
<http://publish.ust.hk/acadreg/generalreg/index.html>

AI

- ▶ AI is allowed—and encouraged, except during midterm & final exams
- ▶ You may use AI to solve homework
- ▶ **But:** You must be able to solve similar problems on your own in exams

Pupils using AI have higher average homework scores...

China*, Jan 2023-Jun 2025



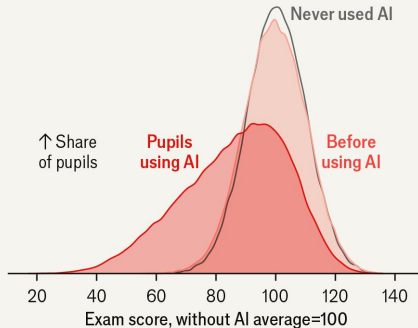
*26,811 pupils aged 12-18

Source: "The generative AI learning penalty",
by D. Strömberg et al., preprint June 2026



...but come exam time the technology proves less helpful

China*, Jan 2023-Jun 2025



*26,811 pupils aged 12-18

Source: "The generative AI learning penalty",
by D. Strömberg et al., preprint June 2026



Schedule (subject to change)

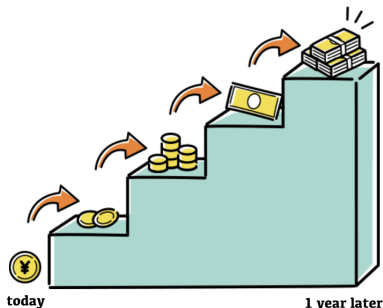
No	Course Content	Readings
1	Introduction	Slides, Syllabus, BKM 2-12
2	Trading Securities	Slides, BKM 28-47, 71-77
3-5	Risk, Return, Capital Allocation	Slides, BKM 111-137
6,7	Portfolio Theory	Slides, BKM 147-166
8-10	Capital Asset Pricing Model (CAPM), ATP, Multifactor Models	Slides, BKM 194-213
11-13	Efficient Market Hypothesis, Information in Financial Markets	Slides, BKM 226-251
14	Portfolio Performance Evaluation	Slides, BKM 86-96, 111-115, 581-591
15	Midterm Exam	
16	Behavioral Finance	Slides, BKM 258-274
17,18	Fixed-Income Securities, Term Structure	Slides, BKM 283-317
19-21	Derivatives	Slides, BKM 475-497, 509-529, 547-565
22,23	Market Structure	Slides
24	FinTech	Slides
25	Final Revision	
26	Final Exam	

Introduction

Investment

What is investment?

- ▶ Allocation of resources (money, time, etc) between **time** and **states**
 - ▶ Current commitment of money
⇒ expect to reap future benefits in different states of the world
 - ▶ Current vs. future: sacrifice now and get something back later
 - ▶ Many different possible states in the future



Investment

What is investment?

- ▶ What will you get?
 - ▶ Hope to get more than you sacrifice
 - ▶ But the future is **uncertain!**
- ▶ The best strategy to maximize *what*?
 - ▶ \$ you get?
 - ▶ But you may want to avoid uncertainty
 - ▶ *utility* = measure of satisfaction received from consuming goods, services, and money, incorporating risk



Finance

Tool to understand what you should do in markets

Field of research that investigates financial market

- ▶ **Asset pricing**

- ▶ What is the fair price of an asset?
- ▶ e.g., Black-Scholes-Merton formula



- ▶ **Corporate finance**

- ▶ Firm's value and its decision making
- ▶ e.g., Modigliani–Miller theorem



- ▶ **Market microstructure**

- ▶ How market quality depends on trading rules, mechanisms, and environment

This Course: FINA 3103

- ▶ **Asset pricing and market structure**
- ▶ How to invest wisely in financial assets
 - ▶ in an uncertain environment
 - ▶ with various market structures and trading rules
- ▶ Not how to predict the future
 - ▶ Which state will happen?
 - ▶ We learn faire valuation

Trading Financial Securities (Class 2)

What to trade?

Suppose you got 10M HKD. What to do?

- ▶ Safe assets

- ▶ put money in your bank (saving) account
- ▶ buy government bonds/ AAA corporate bonds



- ▶ Risky assets

- ▶ stocks (equities)
- ▶ commodities, real estates
- ▶ high-yield bonds
- ▶ derivatives
- ▶ currencies
- ▶ cryptocurrencies, digital tokens, NFT



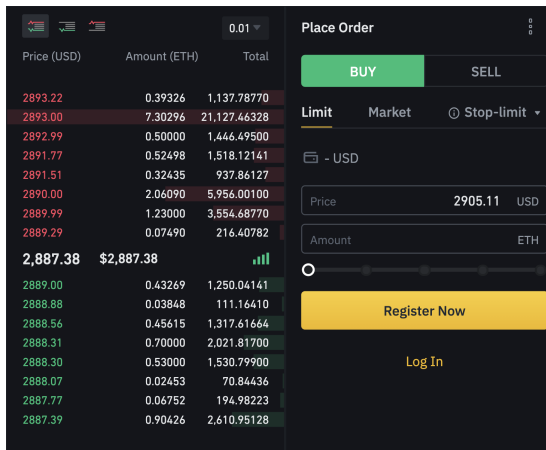
Trading Financial Securities (Class 2)

How to trade?

- ▶ Safe assets
 - ▶ Deposit? Just open a bank account (easy)
 - ▶ Buy bonds? Not easy for individuals like you and me
 - ▶ Market?
 - ▶ Treasury auction (primary market)? No
 - ▶ We will access to secondary markets via designated dealers
 - ▶ What are they?
- ▶ Risky assets
 - ▶ Stocks and derivatives?
 - ▶ Retail access is possible but still indirect, e.g., you can buy via Robinhood and SoFi
 - ▶ Crypto assets?
 - ▶ We have direct access (why?)
 - ▶ Setup crypto wallet and trade on and off blockchain

Trading Financial Securities (Class 2, 20-21)

More in detail?



- ▶ Most modern tradings use “limit-order books”
- ▶ What is the “price”? (bid, ask, midpoint, etc)
- ▶ Various order types (e.g., market order, limit order, stop limit, etc)

Trading Financial Securities (Class 2, 20-21)

Trading mechanism

- ▶ Centralized exchanges
 - ▶ "On exchange," e.g., NYSE, Nasdaq, HKEX, etc
 - ▶ "Off exchange," such as alternative trading systems (ATS) like dark pools
- ▶ Over-the-counter (OTC) market
 - ▶ Bilateral trading with search and matching
- ▶ All about **market microstructure**

Money Allocation and Uncertainty (Class 3-5)

- ▶ Making decision under uncertainty
- ▶ Risk-return relationship:
 - ▶ Saving: no risk but low return
 - ▶ Going to LasVegas: high return but fastest way to lose
- ▶ In general, high expected return comes with high risk

Money Allocation and Uncertainty (Class 3-5)

Uncertainty and Risk

- ▶ How to measure risk? Attitude toward risk?
 - ▶ risk aversion, risk neutral, risk loving
- ▶ Which one do you like?
 1. 10k HKD for sure
 2. 20k HKD with prob. $1/2$ and 0 HKD with $1/2$
 - ▶ same expected return but different risk
- ▶ Formalized by **utility function**
 $\Rightarrow$ your objective function when you allocate money

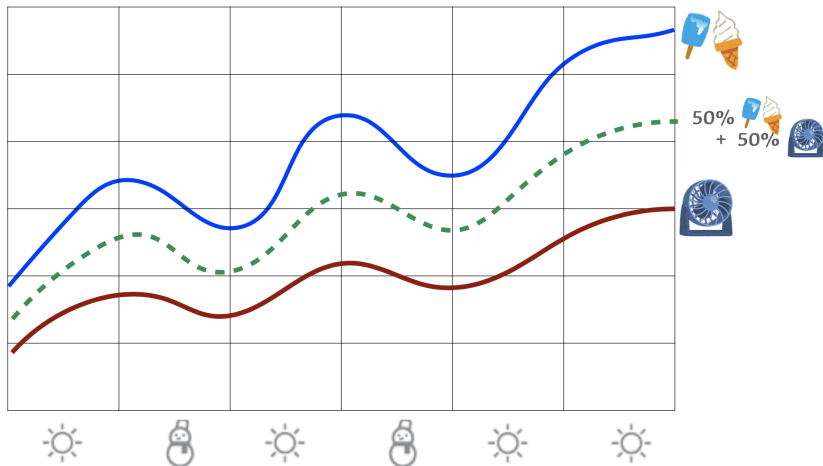
Modern Portfolio Theory (Class 6-7)

Portfolio to control risk

- ▶ Can we avoid risk? Control risk-return tradeoff?
- ▶ Each asset may be risky; What about a *combination* of assets?
 - ▶ A set of assets = **portfolio**
 - ▶ You can diversify risk
 - ▶ What risk can(not) be diversified?
- ▶ (Personally, the most useful concept I learned in college)

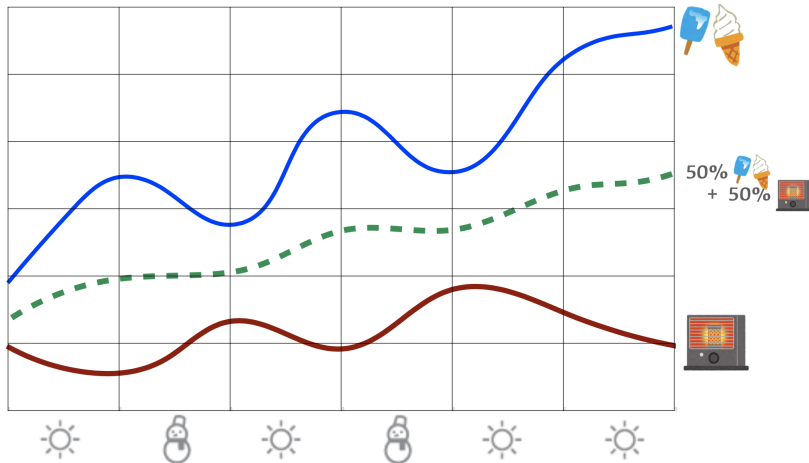
Modern Portfolio Theory (Class 6-7)

- ▶ Two stocks that are affected similarly by the same factor
- ▶ Buying these two (= portfolio) does not reduce risk



Modern Portfolio Theory (Class 6-7)

- ▶ Two stocks with opposite reactions to the same factor
- ▶ Can reduce risk, called “risk diversification”



Asset Pricing (class 8-10)

What is the fair price of an asset?

- ▶ Everyone buys/sells assets motivated by risk and return
- ▶ Return and risk (volatility) arise from changes in **asset prices**
 - ▶ Price $p \Rightarrow$ demand and supply of assets
- ▶ What is **efficient** (fair) price of an asset?
 - ▶ “Demand = supply” $\Rightarrow$ asset price p^*
- ▶ Important concepts: **law of one price, arbitrage, market efficiency**

Asset Pricing (Class 8-10)

Law of one price and arbitrage

Bitcoin Markets

Spot

Perpetual

Futures

# ▲	Source	Pairs	Price	+2% Depth	-2% Depth
1	 Coinbase Exchange	BTC/USD	\$37,047.76	\$25,175,989.53	\$13,384,639.44
2	 FTX	BTC/USD	\$37,040.00	\$36,389,318.96	\$10,360,359.49
3	 Bitfinex	BTC/USD	\$37,065.00	\$14,727,783.99	\$14,992,395.90
4	 FTX US	BTC/USD	\$37,045.00	\$25,579,504.33	\$25,743,856.72
5	 Kraken	XBT/USD	\$37,050.60	\$30,045,835.18	\$23,225,066.82
6	 Bitstamp	BTC/USD	\$37,058.58	\$4,590,392.19	\$5,225,533.26
7	 Binance.US	BTC/USD	\$37,053.71	\$2,438,385.90	\$2,081,076.11
8	 Gemini	BTC/USD	\$37,037.44	\$3,928,676.03	\$5,230,213.35
9	 bitFlyer	BTC/USD	\$37,039.38	\$610,530.98	\$498,523.27
10	 Bittrex	BTC/USD	\$37,051.12	\$1,203,129.95	\$967,237.13

Asset Pricing (Class 8-10)

Arbitrage pricing, CAPM, Factor models

- ▶ What is arbitrage? “Free lunch”
 - ▶ zero-risk, zero-net investment, still generating profits
- ▶ Violation of law of one price = arbitrage opportunity
- ▶ Arbitrage survives?
 - ▶ Prices will converge to an **efficient price**
 - ▶ Arbitrage profits disappear
⇒ market is **efficient**

Efficient Market (Class 11-13)

Information in financial markets

- ▶ Efficient market = market incorporates all available **information**
 - ▶ Traders may privately know something important about a stock
- ▶ Good news $\Rightarrow$ keep buying until no profits remain
 $\Rightarrow$ price reflects your private information so that efficient
- ▶ Is this really happening in reality? Why not?

Efficient Market (Class 11-13)

Information and financial markets

- ▶ One of the issues is rooted in the market structure
 - ▶ Grossman-Stiglitz paradox: Information may not be reflected by the price
 - ▶ Even if traders are rational
- ▶ Or, are we even that rational?
 - ▶ Another issue is how irrational we are

(In)Efficient Market (Class 15-16)

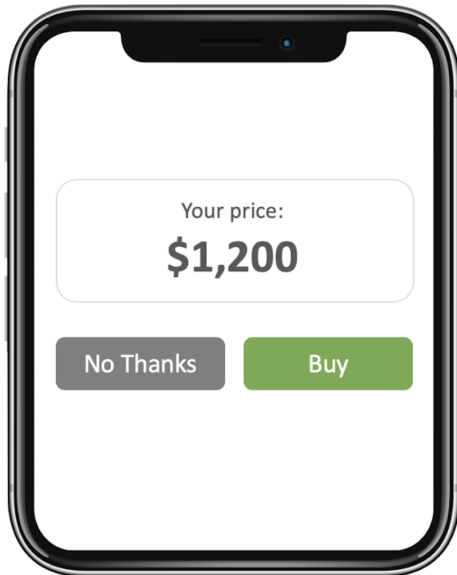
Performance Evaluation and Behavioral finance



International Herald Tribune, October 27, 1989. Kal, Cartoonists and Writers Syndicate, 1989.

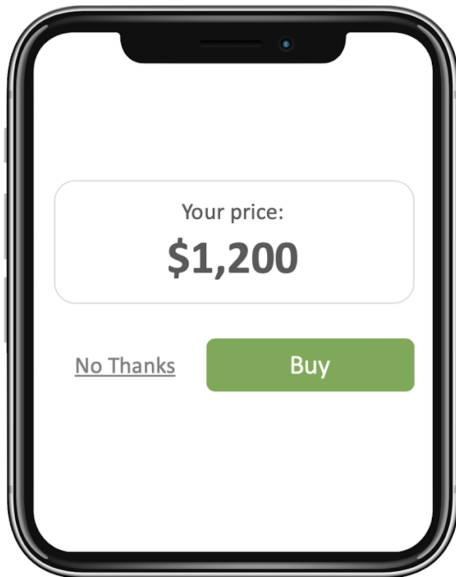
Framing in Marketing

When you purchase something online...



Framing in Marketing

When you purchase something online...

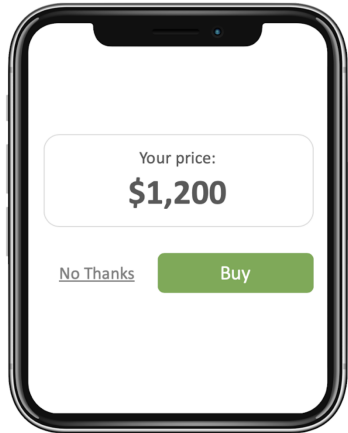
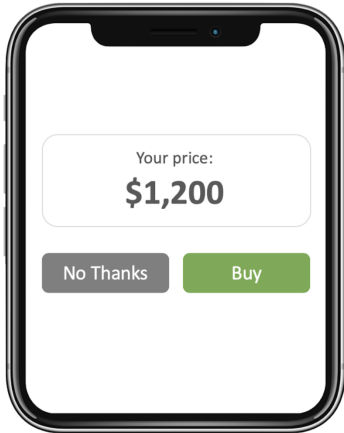


Framing in Marketing

Effect of Salience: more likely to press “buy” in the second framing



The Mobile Spoon



(In)Efficient Market (Class 15-16)

Performance Evaluation and Behavioral finance

- ▶ Investors could earn higher returns
 - ▶ because of their information, skills, sophistication, etc
 - ▶ but it could be due to luck as well
- ▶ The important issue here is to separate luck and skill
⇒ evaluation of portfolio (or manager) performance

Fixed Income Assets and Derivatives (Class 17-19)

- ▶ Bond = fixed income securities
 - ▶ generates fixed (pre-determined) coupon
 - ▶ redemption at face value
- ▶ Derivative = payment based on the prices of other assets
- ▶ Different cash flow structures from stocks
- ▶ Will learn pricing of these assets as well

Market Structures (Class 20-21)

How trading structures affect market quality?

- ▶ Market structures
 - ▶ Fragmented markets, trading speed, transparency, etc.
 - ▶ e.g., 15 National Securities Exchanges in the US
 - ▶ NYSE, Nasdaq, CBOE, IEX, MEMX, ...
 - ▶ Hong Kong, Japan, UK: dominated by one exchange
- ▶ Two important measures of market quality
 - ▶ **Liquidity** = how easy to trade? Price impact of order flow
 - ▶ Buy 10000 shares of IBM stock but all at once or split into small orders?
 - ▶ **Price discovery** = how fast a price impounds news?

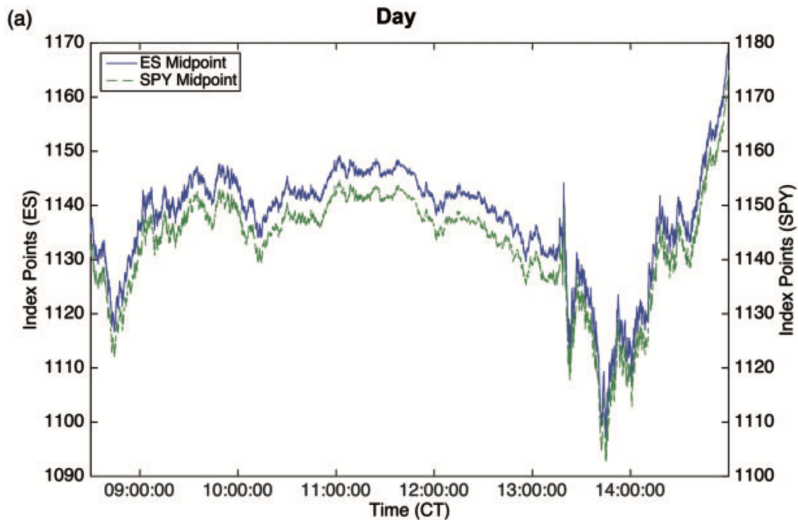
Market Structures (Class 20-21)

Fragmented Market and Latency Arbitrage

- ▶ E-mini: ETF of S&P 500 future (ES)
- ▶ SPDR: future contract of S&P 500 ETF (SPY)
- ▶ Both track the same index (S&P 500) and should have the same price
- ▶ E-mini is traded in Chicago and SPDR is in NY

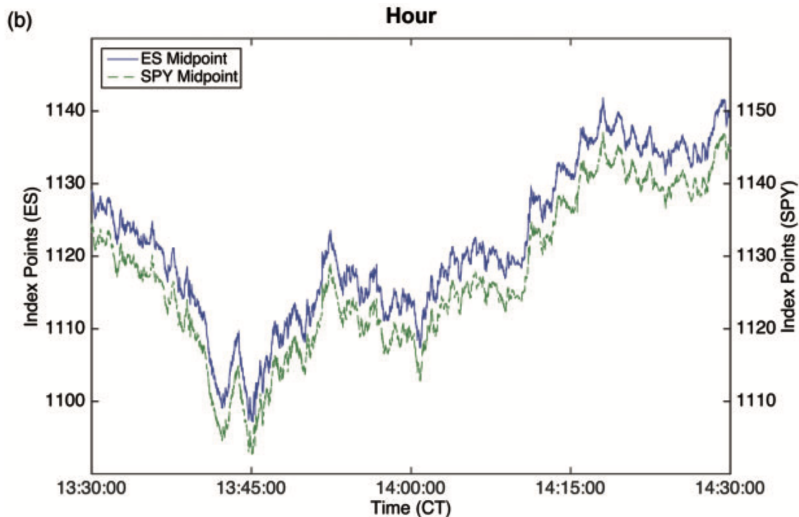
Market Structures (Class 20-21)

Fragmented Market and Latency Arbitrage



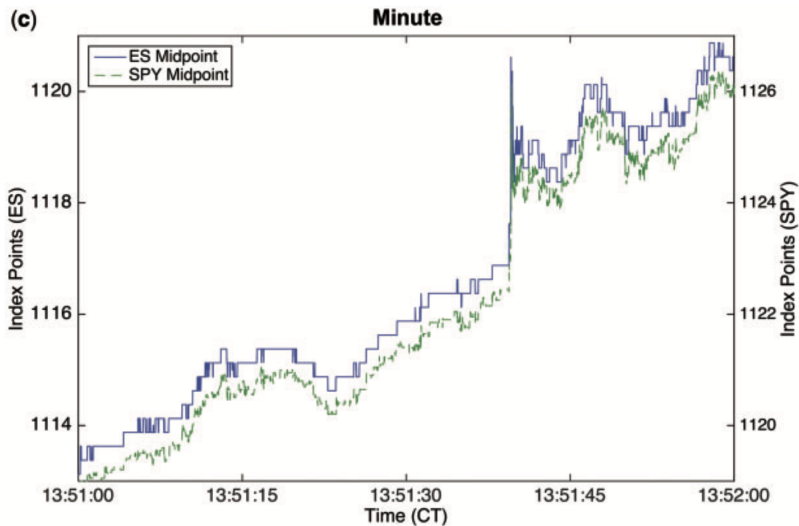
Market Structures (Class 20-21)

Fragmented Market and Latency Arbitrage



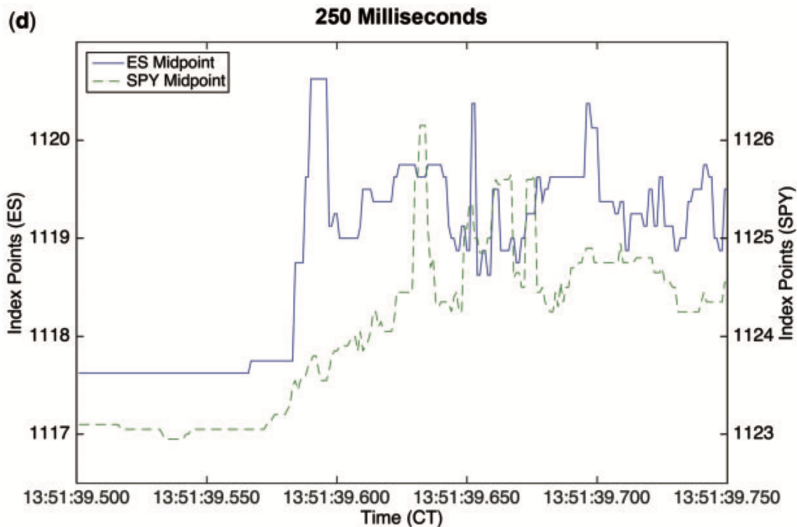
Market Structures (Class 20-21)

Fragmented Market and Latency Arbitrage



Market Structures (Class 20-21)

Fragmented Market and Latency Arbitrage



The Original Trading Floor 1879

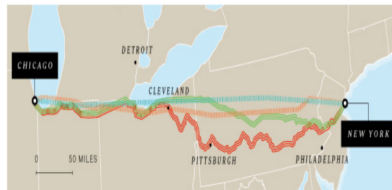


The Actual Trading Floor 2026



Technologies in Financial Markets (Class 22-23)

- ▶ Fragmented market structure $\Rightarrow$ trading speed matters
- ▶ High-frequency trading: speeds of microseconds (millionths of sec) and nanoseconds (billionths)
 - ▶ blinking takes 400 milliseconds
 - ▶ a photon travels in a vacuum from NYC to Chicago in 5 milliseconds



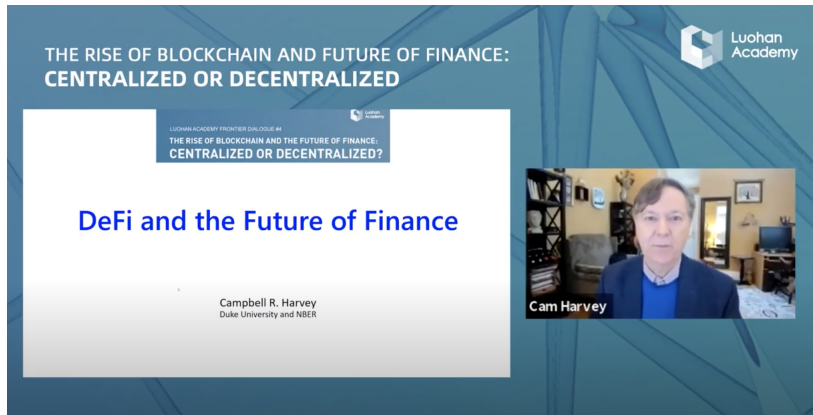
Original Cable	Spread Networks	McKay Brothers	Tradeworx
Buried fiber	Buried fiber	Microwave	Microwave
Mid 1980s	Aug 2010	July 2012	Winter 2012
~1,000 miles	825 miles	744 miles	731 miles
14.5ms	13.1ms	9ms	8.5ms
Follows rail lines	New right of ways	Microwaves faster than photons in fiber	

Blockchain, Cryptocurrency, and More...

- ▶ Blockchain technology, Crypto, DeFi,...
 - ▶ First introduced as underlying record-keeping technology for Bitcoin
 - ▶ Decentralized record-keeping system ($\Leftrightarrow$ centralized system)
 - ▶ More robust and efficient
- ▶ No need to use traditional centralized system
 - ▶ Decentralized exchanges for crypto
 - ▶ Money transfer without banks
- ▶ Democratization of finance (or even more)

The future is happening

- ▶ Cam Harvey (Duke, Fuqua) “DeFi and the Future of Finance”



The screenshot shows a video lecture interface. The background is a dark blue gradient with a faint geometric pattern. In the top right corner, the 'Luohan Academy' logo is visible, consisting of a stylized 'L' icon and the text 'Luohan Academy'. The main content area is a white rectangle with a blue border. At the top of this rectangle, the text 'THE RISE OF BLOCKCHAIN AND FUTURE OF FINANCE: CENTRALIZED OR DECENTRALIZED' is displayed in white. Below this, a smaller blue box contains the text 'LUOHAN ACADEMY FRONTIER DIALOGUE #4' and 'THE RISE OF BLOCKCHAIN AND THE FUTURE OF FINANCE: CENTRALIZED OR DECENTRALIZED?'. The title 'DeFi and the Future of Finance' is prominently displayed in blue. At the bottom of the white rectangle, the name 'Campbell R. Harvey' and his affiliations 'Duke University and NBER' are listed. On the right side of the video frame, there is a small inset window showing a video feed of Cam Harvey, a man with grey hair wearing a blue sweater and a dark jacket. A black name tag at the bottom of the video feed reads 'Cam Harvey'.

THE RISE OF BLOCKCHAIN AND FUTURE OF FINANCE:
CENTRALIZED OR DECENTRALIZED

LUOHAN ACADEMY FRONTIER DIALOGUE #4
THE RISE OF BLOCKCHAIN AND THE FUTURE OF FINANCE:
CENTRALIZED OR DECENTRALIZED?

DeFi and the Future of Finance

Campbell R. Harvey
Duke University and NBER

Cam Harvey