

FINA 3103: Intermediate Investment

Class Note 2: Trading Securities

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Today

Finance = Financial Assets + Financial System + Participants

1. What financial assets are available?
2. Types of markets and how to trade
3. Trading with leverage and short selling

Financial Assets?

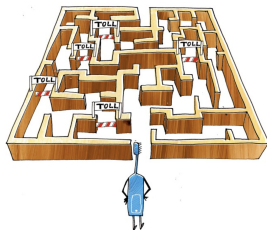
Financial Assets Types



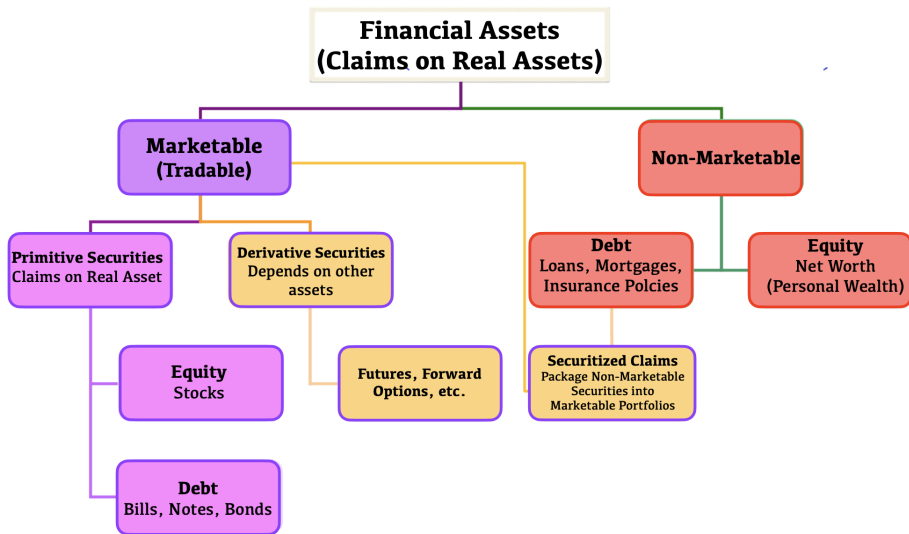
- ▶ **Financial assets:** contracts that govern when and how resources are distributed across **time** and **states**
 - ▶ People and firm want resources at different points of **time**, in different **states** of the world
 - ▶ e.g., today and tomorrow, in boom and recession, etc
- ▶ **Q:** Are digital tokens (BTC ,ETH ,USDC...) new asset class?

Financial System?

- ▶ **Financial system** governs how financial contracts are issued and exchanged
 - ▶ Banks, large financial institutions
 - ▶ Financial markets
- ▶ Regulatory bodies: make sure these contracts to be enforced
 - ▶ e.g., HKSFC, HKMA, CBIRC, SEC (US), CFTC (US)
 - ▶ very complicated frameworks

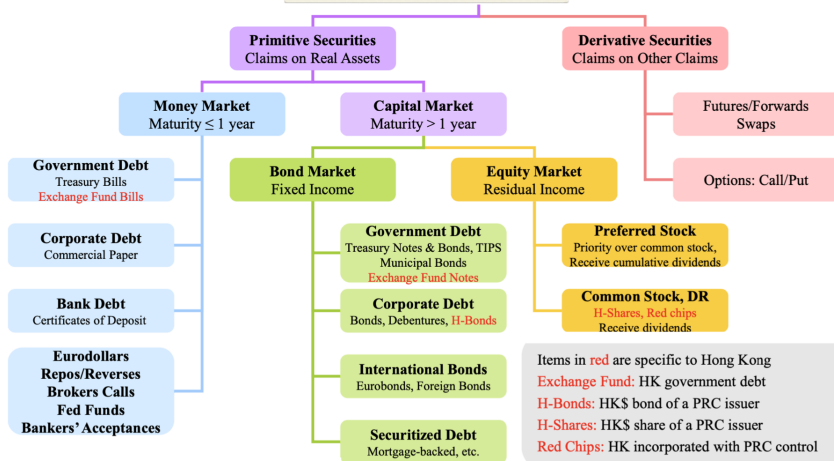


Classification of Financial Assets



Classification of Marketable Assets

Marketable Securities



Money Market Securities

Trading in short-term debt investment (<1y), almost safe

- ▶ **Treasury bills:** short-term debt backed by the US government
- ▶ **Commercial papers:** unsecured (i.e., not backed by collateral) debt issued by large firms
- ▶ **Certificates of Deposit (CD):** deposit with a bank
- ▶ **Eurodollars:** USD deposit at banks outside the US
- ▶ **Repos (Reverse Repos):** selling gov. securities with agreement to buy back later

Capital Market (Bond)

Trading in longer-horizon investment

- ▶ **Treasury Notes and Bonds:** debt issued by US Gov (Notes < 10y; Bonds 10~30y).
 - ▶ TIPS (Treasury Inflation Protected Securities)
- ▶ **Municipal Bonds:** debt issued by municipalities
- ▶ **Corporate Bonds:** debt issued by companies
 - ▶ Debentures: not backed by collateral
- ▶ **Foreign Bonds:** bonds issued by country A 's company in country B and denominated by currency B
- ▶ **Eurobonds:** bonds issued by country A 's company in country B but denominated by currency A
- ▶ **Mortgage-backed Securities:** debt secured by a pool of mortgages (other asset-backed securities)

Capital Market (Equity)

Trading in longer-horizon investment

Equity Capital Market (ECM)

- ▶ **Preferred Stocks:** receive dividends with priority to common stock (typically no voting rights)
- ▶ **Common Stocks:** receive dividends and voting rights
- ▶ **Depository Receipts:** shares of foreign firms traded in domestic market

All types of stocks have

- ▶ Limited liability
- ▶ Residual income
- ▶ Zero or some voting rights

Indices

- ▶ Index measures the price performance of a **basket of securities** using a **standardized methodology**
 - ▶ How stock markets are doing on average?
 - ▶ How fund managers are doing?
 - ▶ Some derivatives priced based on indices
- ▶ What basket?—several kinds:
 - ▶ Stocks (DJI, S&P500) vs. Bonds (Barclays, Merrill)
 - ▶ Narrow coverage (DJI, HSI) vs. Broad (SP500, HSCI)
 - ▶ General (DJI, HSI) vs. Sectoral (HSI-Fin)
 - ▶ Country (DJI) vs. Regional (MSCI)
- ▶ What methodology, how to define an index?
 - ▶ Price-weighted vs. Value-weighted



S&P 500	1,931.34	-0.90
NASDAQ	4,686.50	-47.98
NYSE COMPOSITE	9,857.25	+19.44
DOW COMPOSITE	5,825.39	+45.29

Price-Wighted Indices

Price-weighted index

Index is computed by

$$I_t^P = \frac{\sum_{i=1}^N P_{i,t}}{D_t}$$

where I : index price / $i = 1, \dots, N$: stocks included in the index / $P_{i,t}$: price of stock i at time t / D_t : divisor at time t

- ▶ Let $D = 1$ and think about stock split. What is the problem?
 - ▶ Apple (AAPL) stock split by 1 : 4 in Aug 2020 at price \$500
 - ▶ $P_{\text{AAPL}} = \$500 \rightarrow \125
 - ▶ Stock holders are not affected ($\$500 \times 1 \Rightarrow \125×4)
 - ▶ But I_t^P declines
- ▶ Dow-Jones Index: adjusts D_t to capture splits and mergers

Value-Weighted (Cap-Weighted) Indices

Value-weighted index

Index is computed by

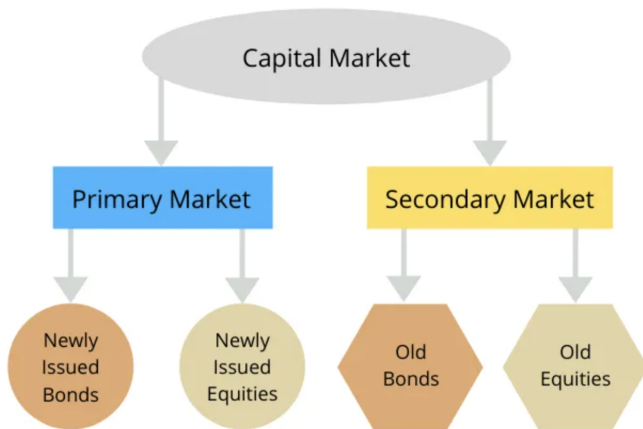
$$I_t^V = \frac{\sum_{i=1}^N Q_{i,t} P_{i,t}}{\sum_{i=1}^N Q_{i,0} P_{i,0}} \times 100$$

where $Q_{i,t}$ is the # of stock i outstanding at time t

- ▶ Average return of index stocks, weighted by **market capitalization**
 - ▶ Stocks with large market caps are heavily weighted
- ▶ S&P 500, Hang Seng Index, FTSE 100, Nasdaq Composite, etc
- ▶ Unaffected by stock splits ($Q_i P_i$ does not change)
 - ▶ e.g., AAPL split $QP = \$500 \times 1 = \125×4

Where can we trade securities?

Primary and secondary markets



Primary Markets for Stocks

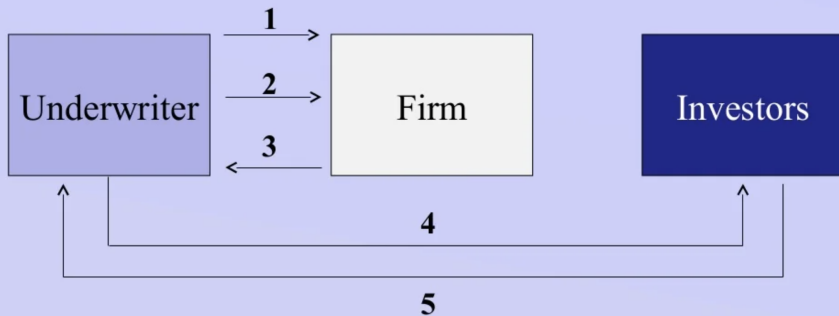
Marketplace where new stocks are issued

- ▶ Firms sell new stocks to raise money
- ▶ They “list” stocks on an exchange platform by
 - ▶ **Initial Public Offering (IPO)**
 - ▶ Seasoned Offering (if stocks are publicly traded already)
- ▶ **Underwriters:** large investment banks help prepare for the IPO
 - ▶ Expected amount of money raised, price, types of securities issued, etc
 - ▶ Intermediaries between the firm and other (small) investors



Primary Markets

IPO and underwriting process



1. Underwriter provides advice to firm
2. Underwriter pays firm for a number of shares
3. Firm provides shares to underwriter to be resold
4. Underwriter offers shares to investors
5. Investors purchase shares from underwriter

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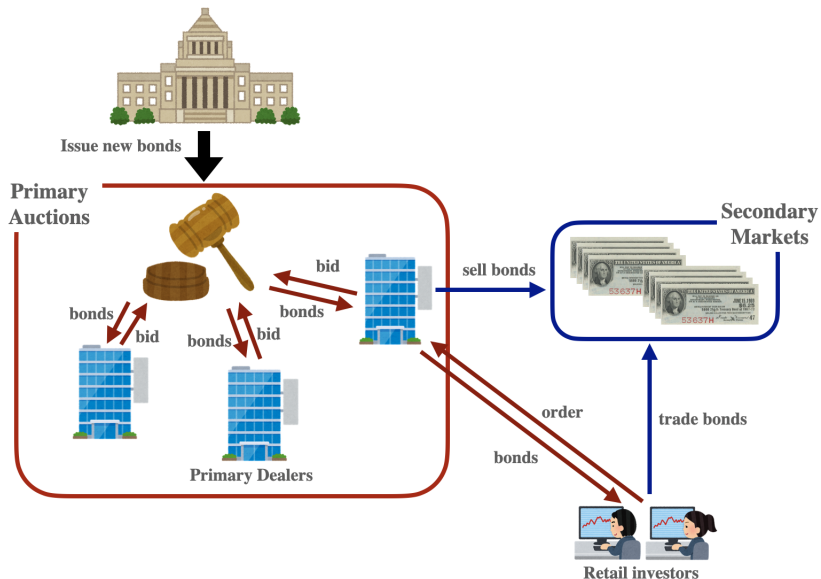
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Primary Markets for Bonds

Marketplace where new bonds are issued

- ▶ Government holds periodic **auctions**
 - ▶ Market size is huge (gov. spending is huge)
- ▶ Large financial institutions participate and bid in an auction as **primary dealers** (PDs)
 - ▶ typically *obligated* to bid a certain amount to stabilize bond issuance
 - ▶ (what is the benefit for them?)
- ▶ Small investors (customers) participate via PDs
- ▶ PDs resale purchased bonds in secondary markets

Primary Auction for Government Bonds



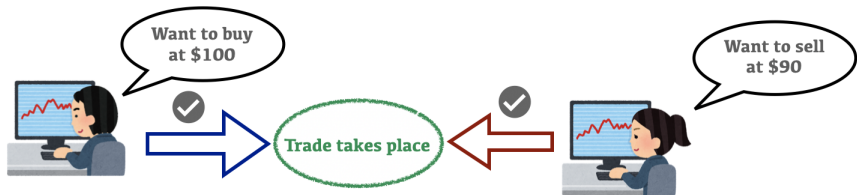
Secondary Markets

Old securities (issued in PMs) are traded between investors

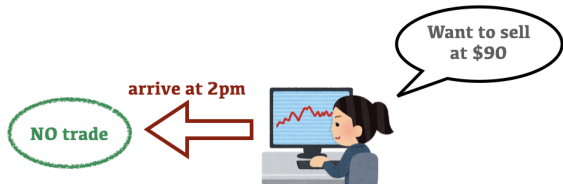
Traders play several roles in the market in terms of **liquidity**

- ▶ **Liquidity:** very important concept in finance
 - ▶ Many meanings depending on the context
 - ▶ In general, how easily you can trade or find trading opportunities
- ▶ **Liquidity providers:** those who provide trading opportunities
 - ▶ Also called **market makers**
- ▶ **Liquidity takers:** those who consume trading opportunities
- ▶ All market participants are taking and/or making markets
 - ▶ Traders' roles depend on market structures

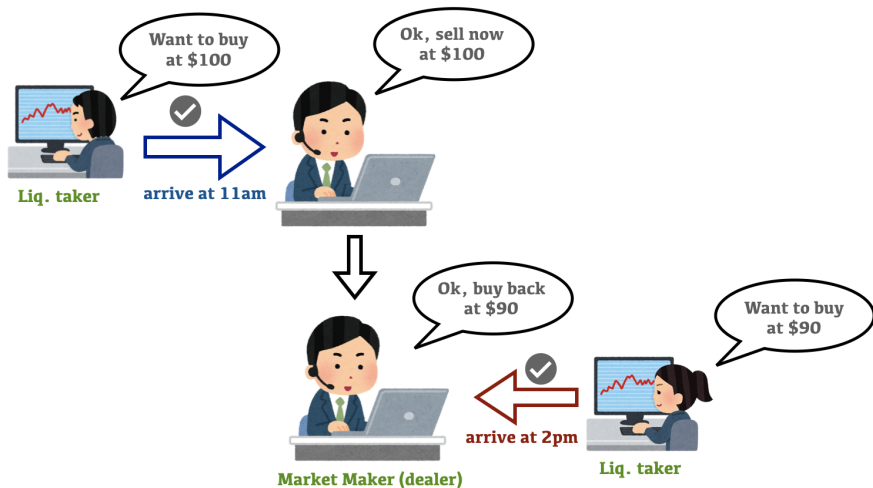
Takers and Makers



Takers and Makers



Takers and Makers



Secondary Markets

Old securities (issued in PMs) are traded between investors

- ▶ Stocks: typically traded on **centralized exchanges**

- ▶ Traders gather together (electronically) and trade
- ▶ NYSE, Nasdaq, HKEX, LSE, etc
- ▶ Dealer markets vs. Auction markets



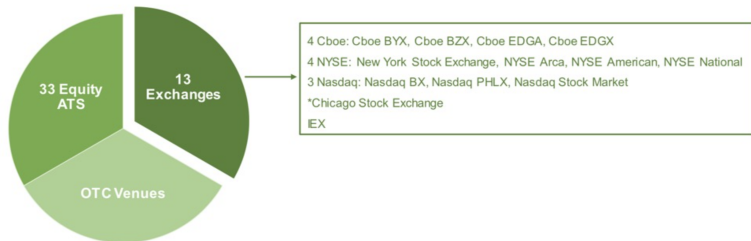
- ▶ Bonds: typically traded **over-the-counter (OTC)**

- ▶ Dealer-customer trading: dealers hold inventory and trade with customer investors
- ▶ Bilateral trading with search and matching
- ▶ (Inter-dealer markets)



Competing Trading Venues in the US

- ▶ Competition benefits users
- ▶ But generates unintended consequences, such as latency arbitrage and HFT



Source: Cboe Global Markets, FINRA, SIFMA estimates

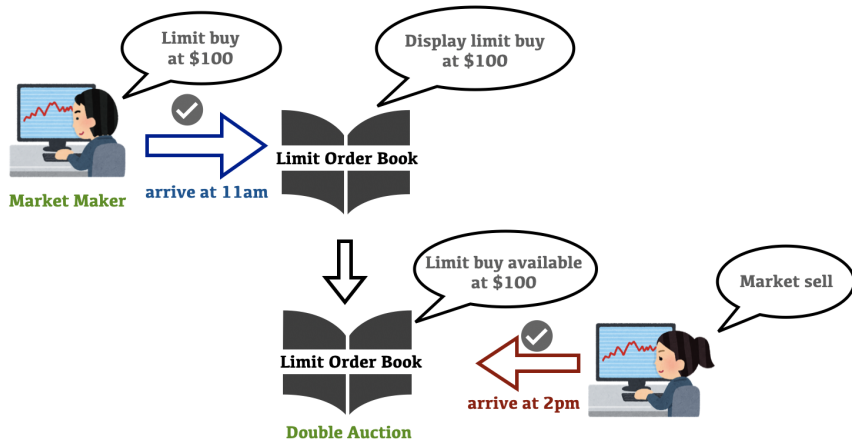
Note: Intercontinental Exchange (ICE) owns the NYSE exchanges, as well as other exchanges and clearing houses across the globe. In April 2018, ICE announced it entered into an agreement to acquire the Chicago Stock Exchange (CHX), pending regulatory approval.

Centralized Exchanges/ Limit-Order Markets

How traders are matched and prices are determined?

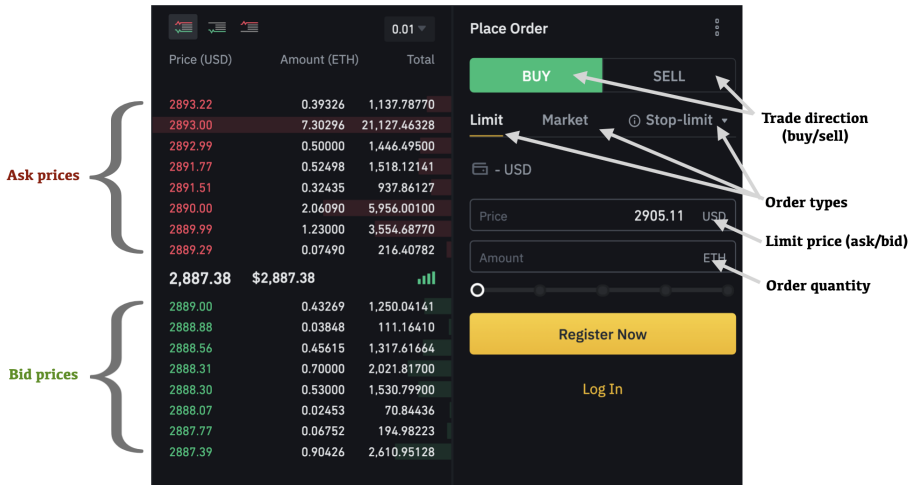
- ▶ Trade execution needs algorithm for matching and pricing
 - ▶ How are buy and sell orders matched?
 - ▶ What is the execution price?
- ▶ **Limit order book** (LOB) is the most commonly-used trading mechanism in modern electronic marketplace
- ▶ Two important concepts:
 - ▶ Bid and ask prices
 - ▶ Limit and Market orders

Limit Order Books



Limit Order Books

What they look?



Limit Order Books

Basic Order Types: Limit Order

Limit orders:

- ▶ Trading quote (offer) specified by (t, i, D, P, Q)
 - ▶ made at time t to trade security i
 - ▶ trading direction $D = \{\text{buy, sell}\}$
 - ▶ quantity (how many shares) Q
 - ▶ at pre-specified ask or bid price P
- ▶ **Ask** price = willing to sell at this price
- ▶ **Bid** price = willing to buy at this price

What does it mean?

“Limit buy order for 500 shares of IBM at bid price \$100”

- ▶ An order to buy 500 IBM shares at \$100 or better (if available)

Limit Order Books

Basic Order Types: Limit Order

Limit orders (cont'd):

- ▶ Limit orders are accumulated in a limit order book
- ▶ They exit if cancelled, or if trade against market orders
- ▶ Matched and executed following the **price-time priority**
 - ▶ Price: LO with better price (for takers) will be matched first
 - ▶ Time: If LOs have the same prices, timing of order entrance matters
- ▶ Providing liquidity to other traders
 - ▶ but can take liquidity as well—called “marketable” limit orders

Limit Order Books

Basic Order Types: Market Order

Market orders:

- ▶ Specified by trading direction (buy or sell) and quantity
 - ▶ Can be seen as a limit order with $(Ask, Bid) = (-\infty, \infty)$

What does it mean?

“Market buy order for 500 shares of IBM”

- ▶ Order to buy 500 shares whatever the price is
- ▶ Basically, a market order is matched with standing limit orders and executed at proposed bid/ask prices
- ▶ Liquidity-taking orders (consuming trading opportunities)

Limit Order Books: Example 1

- What happens if you place “200 shares of **market** sell?”

Quantity	Bid (offer to buy)	Ask (offer to sell)	Quantity
100	\$99	\$101	500
250	\$98	\$102	100
200	\$97	\$103	200
...	...	...	...

Limit Order Books: Example 2

- ▶ What if you place “100 shares of **limit** sell at \$100?”

Quantity	Bid (offer to buy)	Ask (offer to sell)	Quantity
100	\$99	\$101	500
250	\$98	\$102	100
200	\$97	\$103	200
...	...	...	...

Limit Order Books: Example 3

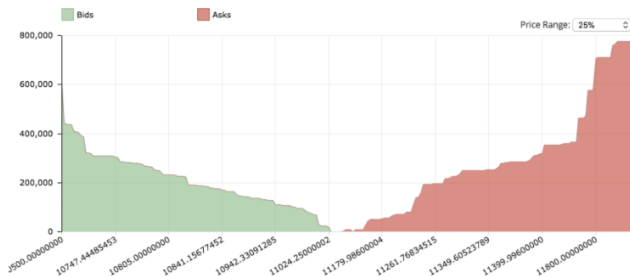
- ▶ What if you place “300 shares of **limit** sell at \$99?”

Quantity	Bid (offer to buy)	Ask (offer to sell)	Quantity
100	\$99	\$101	500
250	\$98	\$102	100
200	\$97	\$103	200
...	...	...	...

Limit Order Books

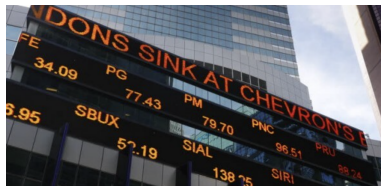
Terminology

- ▶ Bid-ask spread: difference between best ask and bid prices
 - ▶ represents a trading cost and is used as a measure of liquidity (why?)
- ▶ Midpoint price (midpoint quote): $\frac{\text{Ask} + \text{Bid}}{2}$
 - ▶ used as the “fair price” of an asset (Class 20-)
- ▶ Market depth
 - ▶ depth at price p = quantity offered at price p (shape of the curve?)



The “Price” of an Asset

- ▶ What are the prices shown on the “stock ticker tapes”?
- ▶ What is the price shown in the middle of the LOB?
- ▶ What do we mean by “AAPL is now \$100”?



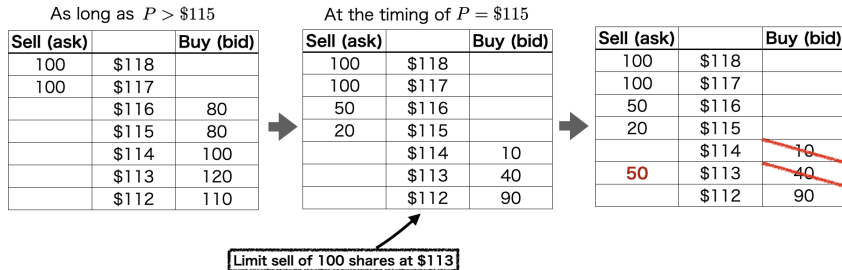
- ▶ They mean the last execution price
≠ best bid/ask, mid-point quote

Stop Orders

- ▶ **Stop orders**; specify the “trigger (stop)” price P_S
 - ▶ Can be both market and limit orders
- ▶ Instruction to buy (or sell) only if the last execution price hits and goes beyond (below) P_S

Stop Orders: Example

- ▶ Stop limit sell for 100 shares at ask = \$113, stop price = \$115
 - ▶ It will be activated (placed) if $P \leq P_S$
 - ▶ As long as the price is sufficiently high, you hold your stock
 - ▶ Only if the price starts to decline, you sell your stock



- ▶ Benefit?

Stop Orders: Example

Exercise

In the same situation, suppose that you set the ask price of your stop limit sell at \$117. What does the LOB in the last picture look like? What if your order is stop market sell?

As long as $P > \$115$

Sell (ask)		Buy (bid)
100	\$118	
100	\$117	
	\$116	80
	\$115	80
	\$114	100
	\$113	120
	\$112	110



At the timing of $P = \$115$

Sell (ask)		Buy (bid)
100	\$118	
100	\$117	
50	\$116	
20	\$115	
	\$114	10
	\$113	40
	\$112	90



Limit Order Books

Distinctive Features

- ▶ A discriminatory double auction
 - ▶ Possibly no unique market-clearing price such that demand = supply
- ▶ Price-time priority
 - ▶ Structural flaw that encourages HFT and worthless speed investment
- ▶ Different transparency regime
 - ▶ Sometimes “hidden orders” with lower priority are placed
- ▶ Important frictions
 - ▶ LOs = ex-ante commitment (place order before trade), giving options to other market participants

Trading Mechanism: NYSE vs. Nasdaq

- ▶ **NYSE** operates as an **auction market** (or called double auction)
- ▶ Retains physical trading floor (with human)
 - ▶ but a large portion is on pure electronic system (Mahwah, NJ)

NYSE to temporarily close floors, move to electronic trading amid coronavirus outbreak

Source: Xinhua | 2020-03-19 06:15:29 | Editor: xyl

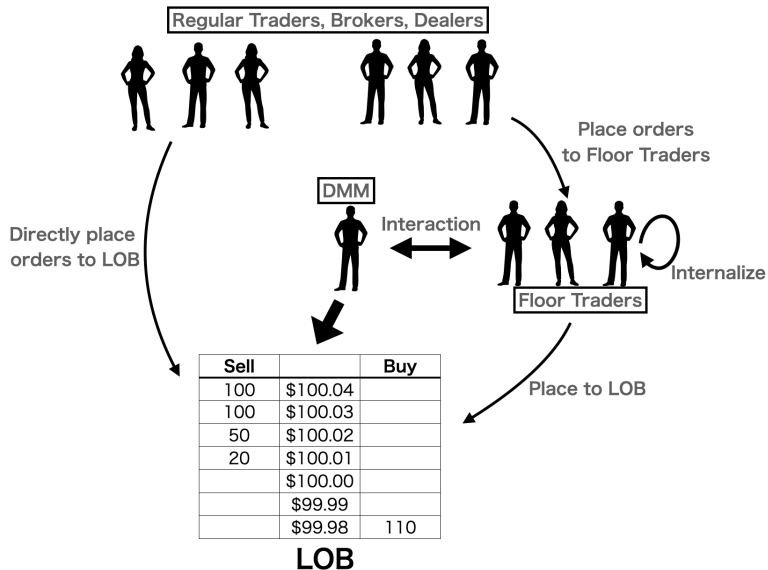


Traders work at the New York Stock Exchange (NYSE) in New York, the United States, on March 18, 2020. The New York Stock Exchange (NYSE) said Wednesday it will temporarily close its trading floor and move to fully electronic trading because of the COVID-19 outbreak. (Photo by Michael Nagle/Xinhua)

DMM in NYSE

- ▶ Traders arrive as buyers and sellers, placing market and limit orders
- ▶ Trade is facilitated by Designated Market Makers (or Specialists)
 - ▶ Each stock has a DMM as an auctioneer
 - ▶ Large institutions, such as Goldman Sachs, Credit Suisse, Deutsche Bank
- ▶ DMMs just enhance trading, not actively trade for profits

NYSE as Specialist Market



Trading Mechanism: NYSE vs. Nasdaq

- ▶ **Nasdaq** operates as a **dealer market**
 - ▶ National Association of Securities Dealers Automated Quotations
 - ▶ Electronic trading system (no physical floor trading)



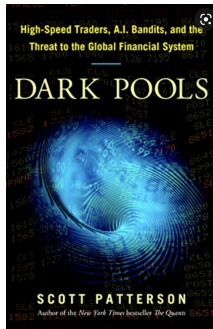
Dealers in Nasdaq

- ▶ Market makers (dealers):
 - ▶ Registered firms trading for its own account (principal traders) and for customer account (agency traders)
 - ▶ Actively display their trading interest for profits as well as customers' limit order
- ▶ Order Entry Firms: brokers, dealers, or trading systems that bring additional customer orders into Nasdaq

Alternative Trading System

Example: Dark Pools trading venue

- ▶ **Non-exchange** trading venues that matches buyers and sellers to find counterparties for transactions
- ▶ Ex., Dark Pools
 - ▶ Your order is not displayed
 - ▶ Matched and executed at the mid-point of regular exchanges
 - ▶ if Nasdaq has best ask = \$101, best bid = \$99 for AAPL stock, your order is executed at Midpoint = $(101 + 99)/2 = \$100$
 - ▶ Better execution price but involves execution risk
 - ▶ Called dark pools as it is like a black box



Market Microstructures

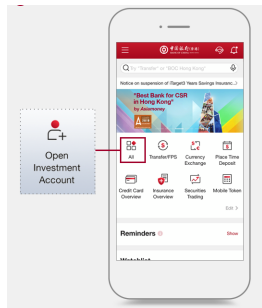
- ▶ Will revisit this market structure analyses in Class 20-23
 - ▶ How does a trading structure affect traders behavior?
 - ▶ What kind of design would be optimal? Any problems in modern structures?
 - ▶ FinTech and Decentralized Finance

Margin Trading and Leverage

Margin Trading

Let's say you want to trade AAPL stock. But how?

- ▶ Typically via a large financial institution (broker)
 - ▶ Open an investment account and transfer your \$
 - ▶ Ask the broker to trade by using your fund
- ▶ If you have X HKD in your account, how much can you trade?
—less than X , more than X , or just X ?



Buying on Margin

- ▶ What? Borrow funds from broker to buy a security
- ▶ Why? To leverage a bet expecting that the security price will **rise**
- ▶ Important notion: “margin”

Margin

Margin is % funded by investor (rest loaned by broker)

$$\text{Margin} \equiv \frac{\text{Account Equity}}{\text{Account (Market) Value}} \times 100$$

where “Equity = Account value - Loan borrowed”

- ▶ Other keywords:
 1. Initial margin: required funding at beginning
 2. Maintenance margin: minimum required margin during investing
 3. Margin call: if current margin < maintenance margin, need to put money to fund account, or broker sells margined security.

Buying on Margin: Example

- ▶ Initial stock price of IBM: $P = \$70$
- ▶ Number of shares bought: $Q = 1,000$
- ▶ Initial Margin: $IM = 50\%$
- ▶ Maintenance Margin: $MM = 40\%$
- ▶ What is your initial position?

Asset	Liability
Stock: \$70,000	Loan: \$35,000
	Equity: \$35,000

Maintenance Margin: Example

Excercise

What if IBM price declines: $P = \$70 \rightarrow P = \60 ?

$$\text{Margin} = \frac{\text{Account Equity}}{\text{Account Market Value}} \times 100 = \frac{\text{Asset Val} - \text{Loan}}{\text{Account Market Value}} \times 100$$

=

Asset	Liability
Stock:	Loan:
	Equity:

Margin Call: Example

Exercise

At what price P^* the margin call will be triggered?

- ▶ Compute P^* that makes $\text{Margin} = 40\%$:

$$\text{Margin} = \frac{\text{Asset Val} - \text{Loan}}{\text{Account Market Value}} \times 100$$
$$=$$

$$\therefore P^* = ??$$

- ▶ If the price dips below P^* , you get a margin call 🙄

Leverage and Return

What is the effect of margin trading on your return?

- Leverage magnifies returns, both up and down

Start Equity	\$35,000	\$35,000
Margin (Leverage)	100% (0)	50% (2)
Start price	\$70	\$70
Shares bought	500	1000
Start value of position	\$35,000	\$70,000
End price	60	60
End value	\$30,000	\$60,000
End equity	\$30,000	\$25,000
Return on Equity (ROE)	-14%	-29%

Short Selling

- ▶ What? Borrow security from broker and sell it
- ▶ Why? To bet that the security price will **go down**
 - ▶ sell now and then buy back at lower price
- ▶ Need to post collaterals, usually liquid assets (like T-Bills)

Margin for shorting

If you are short-selling, the margin is defined by

$$\text{Margin} = \frac{\text{Asset Value} - \text{Loan}}{\text{Loan}}$$

Short Selling: Example

- ▶ Initial stock price of IBM: $P = \$100$
- ▶ Number of shares shorted: $Q = 1,000$
- ▶ Initial Margin: $IM = 50\%$
- ▶ Maintenance Margin: $MM = 30\%$
- ▶ What is your position?

Asset	Liability
Cash:	Short:
T-Bills: (collateral)	Equity:

Short Selling: Example

How to derive money from short selling?

Example

Suppose the price declines $P = \$100 \rightarrow P = \70 . What is your profit?

- ▶ Close short position by buying $Q = 1000$ shares at $P = \$70$
 - ▶ Return what you borrowed from broker
- ▶ Your gain is

$$\begin{aligned}\text{Gain} &= \$30,000 \\ &= \underbrace{\$100 \times 1,000}_{\text{from short selling}} - \underbrace{\$70 \times 1,000}_{\text{buy and close position}}\end{aligned}$$

- ▶ If the price declines, you earn profit
- ▶ But if prices go up, you may get a margin call

Margin Call: Example

Increase in price may trigger margin call

Exercise

What if IBM price goes up? $P = \$100 \rightarrow P = \110

$$\text{Margin} = \frac{\text{Asset Val} - \text{Loan}}{\text{Loan}} \times 100$$
$$=$$

Margin call?

Asset	Liability
Cash:	Short:
T-Bills: (collateral)	Equity:

Short Selling Margin

- ▶ Why we define short-selling margin like this?

$$\text{Margin} = \frac{\text{Asset Value} - \text{Loan}}{\text{Loan}}$$

- ▶ P : initial stock price, Q : quantity shorted, m : initial margin
- ▶ Bank's POV: lends Q shares of stock and has claim on it
- ▶ Maintenance margin is to improve the likelihood of repayment

Short Selling Margin

- ▶ If $P \rightarrow P'$, bank's claim value becomes $P'Q$
- ▶ Your equity is

$$\underbrace{PQ}_{\text{cash borrowed}} + \underbrace{mPQ}_{\text{collateral}} - \underbrace{P'Q}_{\text{loan value}}$$

- ▶ Keep the ratio of equity to bank's claim sufficiently high:

$$(1 + m)PQ - P'Q > xP'Q$$

$$\therefore \underbrace{\frac{(1 + m)PQ - P'Q}{P'Q}}_{\text{your current margin}} > x = \text{maintenance margin}$$

- ▶ Left-hand-side is decreasing in P' : the higher the price, the more likely the margin call occurs