HANDOUT OF

FINANCIAL MARKETS AND INSTITUTIONS

First Partial

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Written by Benedetta Burston

Introduction

Financial markets are structures through which funds flow in different markets:

- Primary Markets: funds raised through new issues of financial instruments; fund users have new projects and fund them by issuing new securities on the primary market, investment banks can serve as intermediaries. Primary markets include IPOs.
- Secondary Markets: trades after the issue on the primary market, corporate security issuers are not directly involved in transfers, instruments can be backed by mortgages and other assets. Secondary markets offer buyers and sellers liquidity.
- Derivative Markets: the payoff of a derivative is linked to the one of another, previously issued; these contracts involve an agreement to exchange a standard quantity of asset at a predetermined price and specified date.
- Foreign Exchange Markets: where transactions involving the sale of assets denominated in foreign currency take place, conversion of value leads to foreign exchange risk, which derivatives can help hedging.
- Money Markets: they trade debt securities or instruments with maturities <=1 y. Instruments are: treasury bills (short-term issued by the US gov.), federal funds (daily transfers among banks, uncollateralized), repurchase agreements (sale of a security with the promise to repurchase it a specific date and price= short term collateralized loans), commercial papers (very liquid low risk short-term loans), negotiable certificates of deposit (instruments that secure an amount for a period of time and at an interest, they are negotiable), banker's acceptance (promise from a bank to pay the supplier at a future date).
- Capital Markets: they trade equity (stocks) and debt (bonds) with maturities > 1y. Instruments are: corporate stock (ownership claims), mortgages (loans to po purchase real property), corporate bonds (long-term bonds), treasury bonds (long-term bonds issued by the US gov.), State and Local Government Bonds (long-term, issued by state and local gov.), US Government agency bonds (long-term bonds issued by gov. agencies collateralized by a pool of assets), Bank and Consumer Loans (loans to commercial banks and individuals).

Financial instruments are subject to **regulations** imposed by regulatory agencies as the SEC (Securities and Exchange Commission), which requires firms to register their securities and to describe the issue and the associated risk in a prospectus (legal document). The SEC monitors trading on the major exchanges to avoid insider trading.

Financial institutions channel funds from those with surplus of funds (suppliers) to those with shortages of funds (users of funds). Types of Financial Institution:

- Commercial banks: depository institutions whose major assets are loans and major liabilities are deposits.
- Thrifts: banks that specialize in offering property-buying related loans, they are saving associations, banks and credit unions.
- Insurance companies: protect individuals and corporations from adverse events.
- Investment banks: help firm issue securities and relative activities.
- Finance companies: companies specialized in providing loans.
- Investment funds: pooled investment vehicles that allow individuals and institutions to invest in a diversified portfolio.
- Pension funds: offering saving plans to individuals.

Banks and credit unions that take deposits from customers need to be regulated by the government to protect customers' deposits, but the regulations can be costly for these institutions.

Insurance companies, on the other hand, receive income from customers' premiums, allowing them to take on more risk with their investments, which can lead to potentially higher returns for investors with lower regulatory costs.
Financial Institutions play a crucial role by tackling three key issues of the functioning of financial markets:

1) Monitoring costs: expenses incurred by investors in monitoring their investments to ensure that their money is being used effectively by the borrower.
2) Liquidity costs: expenses incurred by investors who want to convert their investments into cash quickly.
3) Price risks: uncertainty that investors face due to changes in market conditions, such as interest rates or exchange rates.

The role of Institutions:

- Benefitting suppliers of funds: monitoring costs, liquidity and price risks, transaction cost services, maturity intermediation, denomination intermediation.
- Benefitting overall economy: money supply transmission, credit allocation, intergenerational wealth transfers, payment services.

In performing these services, financial institutions incur in different type of **risks**:

- Credit risk: borrower might default on their debt obligations and fail to repay.
- Foreign exchange risk: changes in value due to changes in the value of currencies.
- Country risk: risk that an investment in a foreign country may be adversely affected by political, economic, or social conditions in that country.
- Interest rate risk: risk that an investment's value will decline due to changes in interest rates.
- Price risk: risk that an investment's value will decline due to changes in market prices.
- Liquidity risk: risk that an investor will not be able to sell an investment when needed or will be forced to sell at a loss due to a lack of buyers in the market.
- Insolvency risk: risk that a firm will be unable to satisfy its debts.

Financial institutions are regulated in order to prevent market failures and their cost on society. Regulations provide social benefits and welfare but also impose private costs on individual financial institutions' owners and managers.
Thanks to the rapid growth of international markets, we can talk about a globalization of financial markets and institutions, due to the increase in the pool of savings in foreign countries, international investors turning to the US to expand, accessibility to information on foreign investments, offerings to invest in foreign securities by US institutions, the introduction of the euro, economic growth in Pacific countries and deregulation in foreign countries.

Money Markets

In money markets short term debt instruments are issued by economic agents that require short term funds and are purchased by economic agents that have short term excess funds.
Once issued, instruments are traded in active secondary markets.
Money market instruments have higher rate of interest than holding cash (yields 0 interest) but are very liquid and therefore have a relatively low default risk.

- Large denomination: the need is usually for large amounts of cash, so transactions costs are low and the size of initial transactions allows for indirect individuals' investment.
- Short maturities: low interest rate risk and required rate of return.
- Low default risk: money market instruments can usually be issued only by high quality borrowers with little default risk.

Elements:

- Treasury bills: short-term obligations issued by the US Government, virtually default risk free, highly liquid, low interest rate risk, the Federal Reserve uses this tool, along with other policy

tools such as setting interest rates, they have a strong international demand, as in during the financial crisis since they are a safe investment.

- Federal funds: banks and other depository institutions lend funds to each other overnight, usually to meet reserve requirements, their rate is set as part of the monetary policy. Correspondent banking is when two banks have a relationship and one bank provides services to another bank in a different location. Reciprocal accounts are when two banks hold accounts with each other, which allows them to transfer funds and process transactions more efficiently. Since it is usually a overnight loan, it is structured as a single payment or bullet loan.
- Repurchase agreements: repos or RP are short-term collateralized loans, it is a real sale in the sense that title to securities passes to the lender of funds for the term of the agreement. A haircut may apply, being a discount that protects the lender if the market value of the collateral drops: the borrower receives less cash than the market value of the collateral, and they must repay the full value of the collateral at the end of the repo term. A reverse repurchase agreement is the purchase of a security with an agreement to sell it back in the future.
- Commercial papers: unsecured short-term corporate debt issued to raise short-term funds, sold in large denominations, with maturities between 1 and 270 days. They are usually sold to investors indirectly through brokers and dealers, and are held until maturity, having no secondary market. Asset backed commercial papers (ABCP) are backed by assets of the issuing firms.
- Negotiable certificates of deposit: bank-issued, fixed maturity, interest-bearing time deposit that specifies the interest rate and the maturity date. They can be sold on secondary markets, are common in large denominations and are often purchased with pools of funds from individual investors.
- Banker's acceptances: time draft payable to a seller of goods with payment guaranteed by a bank. They are used in international trade to finance the trade of goods that have to be shipped, where banks act as payment guarantors, they are salable on secondary markets.

Participants:

- US Treasury: issuer of T-bills, the most actively traded of the money market securities, allowing the government to raise money to meet unavoidable short-term expenditure needs prior to the receipt of tax revenues.
- The Federal Reserve: most important participant, it sets interest rates, provides liquidity, regulates banks, and conducts open market operations.
- Commercial banks: issuers and investors, as they need to meet reserve requirements, manage deficiencies and obtain additional reserves.
- Money Market Mutual Funds: they purchase large amounts of securities and sell shares in pools, allowing small investor to invest alternatively to interest-bearing deposits.
- Corporations: borrow and invest, issue commercial papers to raise short-term funds.
- Brokers and dealers: there are 23 government security dealers authorized to trade in US government securities. They buy treasury bills from the FED and sell them on the secondary market. Brokers never trade on their own, they are intermediaries (as between government securities dealers).
- Other financial institutions: property causality insurance companies and life insurance companies, their liability payments are relatively unpredictable so they must maintain large balances of liquid assets.
- Individuals: they participate directly or through investment in money market mutual funds.

Bond Markets

Equity and debt instruments with maturities of more than one year are traded in capital market. Bond markets are capital markets in which bonds are issued and traded.

Instruments:

- Treasury notes (T-notes): long-term obligations issued by the US gov. (1-10 years)
- Treasury bonds (T-bonds): long-term obligations issued by the US gov (over 10 years)
- Municipal bonds: securities issued by state and local governments.

- Corporate bonds: long-term debt issued by corporations.

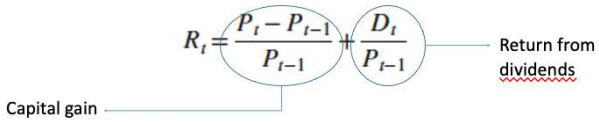
Corporate bonds:

Minimum denomination is 1k$ and coupon-paying corporate bonds pay interest semiannually.
Bond indenture: legal contract specifying rights and obligations of the bond issuer and holders, lowering risk and interest cost of the bond issue.
Bond issuer's performance and repayments are overseen by a trustee appointed as the holders' representative.
Bearer vs registered: bearer bonds have coupons attached which can be presented to the issuers for payments on due date, while registered bonds are directly mailed to the owner, as he is registered (bearer bonds have ownership determined by possession).
Term vs serial: term bonds mature entirely on a single date, while serial bonds mature on a series of dates with a portion paid on each.
Mortgage bonds: issued to finance specific projects with are pledged as collateral, which makes them less risky.
Debentures and subordinated debentures: debentures are bonds backed solely by the general creditworthiness of the issuing firm (unsecured), while subordinated debentures are unsecured but junior in priority to other types of debt which makes them high yield bonds (junk bonds).
Convertible bonds: they may be exchanged for another security of the issuing firm at the discretion of the holder, if the conversion leads to a surplus in value, the holder gains a profit.
Bonds with stock warrants: they give the bondholder the right to purchase a specific number of shares of the issuer's common stock at a predetermined price, within a certain period of time.
Callable bonds: bonds which include a call provision which allows the issuers to require the holder to sell back the bond at a given price.
Sinking fund provisions: the issuer retires a certain amount of the bond issue early over a number of years, reducing the probability of default at maturity date.
Trading process: primary sale happens through either a public sale (issue) or a private placement, then there are two secondary markets, namely the exchange market and the over-the-counter market; these can involve a significant degree of liquidity risk.
Bonds are rated according to creditworthiness by credit agencies (AAA highest to D lowest), different agencies can give different ratings.
Bond markets bring together suppliers (federal, state, local governments and corporations) and demanders (households, business, government units and foreign investors) of long-term funds.
International aspects: international bond markets trade bonds that are underwritten by an international syndicate, offer bonds to investors in different countries, issue bonds outside the jurisdiction of any single country and offer bonds in unregistered form.
Investors: adding international bonds can be a way to diversify risk in portfolio.
Issuers: sophisticated international bond markets increase financing options and motivates domestic markets to implement general improvement.
International bonds can be classified in three main groups:

1. Eurobonds: long term bonds issued and sold outside the country of currency, generally in denominations of 5 or 10k$, they pay interest annually and are generally bearer bonds OTC (over the counter = directly traded between parties, not centralized)
2. Foreign bonds: long term bonds issued outside the issuer's home country, denominated in the country in which they are issued, frequently called international bounds or after their origins.
3. Sovereign bonds: government issued debt, historically issued in foreign currencies, the more development in the country the more credit for political risks, they are uncollateralized, and their price reflects the credit rating of the issuer country.

Stock Markets

The stock market is a cheap and efficient way for people who want to invest their money (suppliers of funds) to give money to companies (users of funds) in exchange for a share in the ownership of the company and a portion of the company's profits (in the form of dividends).
There are two types of corporate stocks: common and preferred stocks (not offered by all corporations, 1% of outstanding value of common stock outstanding).
Legally, common stock or equity owners have an ownership stake, being the right to a share in issuing firm's profit as dividend payments, and a residual claim on assets if the firm fails. Common stockholders have no direct control over a firm's day-to-day operations, but they have voting privileges on major issues of the firms, as election of the board of directors.
Common stockholders have no legal recourse if dividend payments are not received as they have no special or guaranteed right over them.
Dividends are taxed twice, on a firm and on a personal level, but the second taxation can be partially avoided by investing in firms that reinvest to most of earnings for growth rather than paying larger dividends; earnings growth leads to stock price increases, thus stockholders can sell their stocks and pay capital gain taxes which are lower than income taxes on dividends.



Pt = stock price at time t
Dt = dividends paid over time t – 1 to t
(Pt – Pt – 1) / Pt – 1 = capital gain over time t – 1 to t
Dt / Pt – 1 = return from dividends over time t – 1 to t

Residual claim: common stockholders have the lowest priority claim on assets in bankruptcy
Employees → bondholders → taxes→ preferred stockholders → common stockholders
Limited liability: common stockholder losses are limited to the amount of their initial investment in the firm, while when liability is unlimited, stockholders may be liable for the firm's debts out of their total wealth.
Voting rights: common stockholders exercise control over activities indirectly through the election of the board of directors, and other major changes pertaining the firm.
Each share equals one vote.
A **dual-class firm** is a type of company that has two different classes of common stock with different voting rights and dividend payouts assigned to each class. This means that one class of stock may have more voting power than the other or may receive a higher dividend payout.
Election of BoD: cumulative voting is chosen when all directors are voted on the same time, the number of votes assigned equals to the number of shares held:
Np = [(p x # of votes available) / (# of directors to be elected + 1)] +1
Straight voting: election of one director at time, the number of votes for each director equals the outstanding shares, advantage = 50%.

Preferred stock

Preferred stock is a hybrid security that has characteristics of bonds and common stock.

	Preferred stocks	Common stocks	Bonds
Ownership interest	Yes	Yes	No
Payments	Fixed	Variable	Fixed
Bankruptcy proceedings	No	No	Yes
Tax expense	Not deductible	Not deductible	Deductible

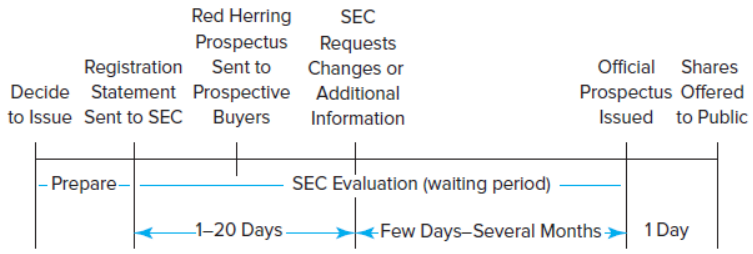
Preferred stocks can be:

- Participating (greater than the promised dividends), or non-participating (fixed regardless any change in firm's profit)
- Cumulative (unpaid dividends accumulate and are priority payment), or non-cumulative (unpaid dividends are never paid).

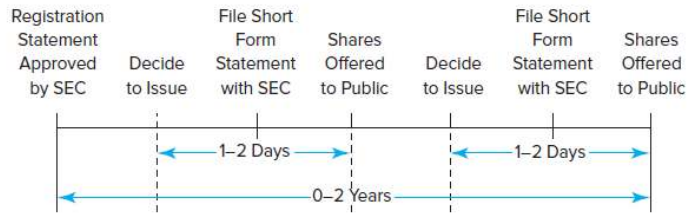
Primary stock markets

Markets in which corporation raises funds through new issues of stocks, sold to investors in exchange of funds that the user needs. An investment bank can act as intermediate using a firm commitment underwriting where the investment bank guarantees the corporation a price for newly issued securities by buying the whole issue at a fixed price; then the investment bank resells the securities to investors at a higher price, the difference is named underwriter's spread. Investment banks can also use a best effort underwriting, where the underwriter does not guarantee a price to the issuer and acts more as a placing or distribution agent for a fee.
A primary market sale may be a first-time issue, initial public offering, or a seasoned offering, when the firm is already present on the secondary market.
In some states, corporate law gives shareholders preemptive rights, to purchase newly issued shares of stock before they are offered to the public.

Process for an IPO:



Getting shelf registration to the investing public:



Secondary stock markets

Markets in which stocks are issued and traded among investors, they usually open at 9.30 and close at 4pm. Each stock is assigned a special market maker, a monopolist with the power to arrange the market for the stock, with the obligation to stabilize the order flow and prices for the stock in turbulent times. Types of transactions:

1. Market order: brokers trade on behalf of customers at the market price.
2. Limit orders: investors sets a maximums price to buy or minimum price to sell, the order will only be executed if the market price is coherent with them.
3. Specialists transact for their own account.

Stock market indexes

A stock market index is a measure of the performance of a specific group of stocks in a particular stock market. It represents a basket of stocks that are selected based on certain criteria, such as market capitalization, industry sector, or geographic location.

Movements in a stock market index provide investors with information on the overall performance of a particular group of stocks and can serve as an indicator of the broader market trends.

Valuing bonds

Companies need to seek out projects with positive net present values.

$$\text{PV} = \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \cdots + \frac{C_T}{(1+r)^T}$$

This is called the **discounted cash flow** (or **DCF**) formula. A shorthand way to write it is

$$\text{PV} = \sum_{t=1}^{T} \frac{C_t}{(1+r)^t}$$

Cn= expected cash flows

$$\text{NPV} = C_0 + \text{PV} = C_0 + \sum_{t=1}^{T} \frac{C_t}{(1+r)^t}$$

C0 is negative if cash flow is an investment.

The discount rate is used to calculate the present value of future cash flows. If the future cash flow is safe, the discount rate is the interest rate on safe securities. If the future cash flow is uncertain, the expected cash flow should be discounted at the expected rate of return offered by equivalent risk securities.

Discount rate: it's used to figure out how much money in the future is worth today. The rate depends on how risky the investment is and how much the money could be worth in the future.

Hurdle Rate: minimum rate of return required by an investor or company before it will consider investing in a project or asset.

Opportunity cost of capital: potential return that an investor could have earned by investing in a different project or asset of similar risk. It is the cost of giving up the opportunity to invest in the best option available.

If you own a bond, you are entitled to a fixed set of cash payoffs of regular interest payments. At maturity, you get back the face value of the bond (bond's principal). In the US, coupons are paid every six months, but it may be an annual payment in other countries.

Bond prices (money lent) are typically represented as a percentage of the bond's face value (amount you get at the end).

If an investor holds a bond until its maturity, they will receive the full-face value of the bond, regardless of its current market price. In addition, they will receive periodic interest payments (also known as coupon payments) during the life of the bond. The total return on investment for the bond will depend on the bond's coupon rate, the purchase price, and the length of time held until maturity. However, if the investor sells the bond before its maturity, the return on investment will depend on the market price of the bond at the time of sale.

A bond's yield to maturity (YTM) is the total return anticipated on a bond if it is held until its maturity date.

A bond that is priced above the face value sells at a premium.

A bond that is priced below the face value sells at discount.

When the yield to maturity is less than the coupon (and the current yield), the bond sells at a premium, when the yield to maturity is greater than the coupon (and the current yield), the bond sells at a discount.

Interest rates generate changes in bond prices, which move in the opposite directions.

Duration

A bond's duration is a measure of how much its price will change in response to changes in interest rates. It tells you how long it will take for you to get your money back from a bond, taking into account the bond's maturity date, coupon rate, and yield to maturity. Duration is expressed in years and it helps investors manage risk by selecting bonds with different durations that are less sensitive to interest rate changes. A change in interest rates has a greater effect on the price of long-duration bonds.

$$\text{Duration} = \frac{1 \times \text{PV}(C_1)}{\text{PV}} + \frac{2 \times \text{PV}(C_2)}{\text{PV}} + \frac{3 \times \text{PV}(C_3)}{\text{PV}} + \cdots + \frac{T \times \text{PV}(C_T)}{\text{PV}}$$

Modified duration measures the percentage change in a bond's price for every 1% change in interest rates.

$$\text{Modified duration} = \text{volatility (\%)} = \frac{\text{duration}}{1 + \text{yield}}$$

Term structure of interest

It refers to the relationship between interest rates and the time to maturity for a set of similar financial instruments, such as bonds or Treasury bills.
The term structure of interest rates is also known as the yield curve, and it shows how interest rates differ across different maturities. Normally, longer-term bonds have higher interest rates than short-term bonds, which creates an upward-sloping yield curve.
The shape of the yield curve is important because it provides information on future economic expectations. For example, an upward-sloping yield curve suggests that investors believe the economy will continue to grow, while a flat or inverted yield curve may indicate a potential economic slowdown.
The law of one price states that in a well-functioning market, the same commodity should sell for the same price. This applies to financial markets as well, where all safe cash payments to be delivered on the same date must be discounted at the same spot rate.
For investors, a risk-free dollar is valued the same regardless of whether it comes from bond A, B, or C.
The yield on bonds increases with maturity because the term structure of spot rates is upward sloping. This means that longer-term bonds have higher yields than shorter-term bonds, reflecting the increased risk associated with lending money for a longer period.

Spot rates

Spot rates are the interest rates on bonds that pay no interest and have a single payment at maturity (strips). They are used to calculate the present value of future cash flows. Spot rates are derived from the prices of these bonds and represent the market's expectation of future interest rates. The price of a strip maturing at a future date t reveals the discount factor and spot rate for cash flows at that date, so all other safe cash payments on that date are valued at the same spot rate.
The expectations theory of the term structure suggests that investors can expect the same return from a series of short-term bonds as they would from a long-term bond. If short-term interest rates are expected to rise in the future, the theory predicts an upward-sloping term structure.
If we understand the relationship between bond returns and maturities, we can use this information to determine which bonds are overpriced or underpriced relative to each other. This can help us make informed investment decisions in the bond market. For example, if we expect interest rates to rise, we may avoid long-term bonds and instead invest in short-term bonds or cash equivalents to avoid the risk of holding bonds with falling prices.

Valuing stocks

Common stocks provide investors with an indefinite stream of dividends, with no fixed maturity date. Investors usually have short-term horizons and invest for both dividends and capital gains.

- **Bid price:** The prices at which investors are willing to buy shares
- **Ask price:** The prices at which current shareowners are willing to sell their shares.
- **Bid-ask spread:** The difference between the bid price and the ask price.
- **Market order:** An order to buy or sell shares at the best currently available market price.

- **Limit order:** An order to buy or sell shares at a predetermined price, to be executed when the market price reaches the requested price.
- **Book Value:** Net worth of the firm according to the balance sheet
- **Dividend:** Periodic cash distribution from the firm to the shareholders
- **P/E Ratio:** Price per share divided by earnings per share
- **Market Value Balance Sheet:** Financial statement that uses market value of assets and liabilities.

The present value of a common stock is determined by the present value of the expected future cash flows, including both dividends and the expected sale price of the stock at the end of the holding period.
The current price of a stock is determined by calculating the present value of expected future dividends. This is done using a discounted cash flow (DCF) model, which takes into account the expected end-of-period price for a single-period investment.
Expected Return: The percentage yield that an investor forecasts from a specific investment over a set period of time. Sometimes called the market capitalization rate.

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}} + \frac{D_t}{P_{t-1}}$$

The price of any share of stock can be thought of as the present value of the future cash flows, which are dividends for a stock.

$$\text{Price} = P_0 = \frac{\text{DIV}_1 + P_1}{1+r}$$ r= market capitalization rate (equity capital)

Dividend Discount Model

The dividend discount model is a method of valuing a stock by estimating the present value of future dividend payments.

$$P_0 = \frac{\text{DIV}_1}{(1+r)^1} + \frac{\text{DIV}_2}{(1+r)^2} + \ldots + \frac{\text{DIV}_H + P_H}{(1+r)^H} P_0 = \sum_{t=1}^{H} \frac{\text{DIV}_t}{(1+r)^t} + \frac{P_H}{(1+r)^H}$$

H= time horizon of investment
As investment horizon increases, the present value of future price decreases while the present value of the dividend stream increases.
The value of a stock is the cash payments investors expect to receive from it, discounted at the rate of return they expect to get from other similar investments. Since stocks have no fixed maturity, their value is determined by the stream of dividends and capital gains investors anticipate. This formula ensures market equilibrium, as any deviation would trigger buying or selling to adjust the price accordingly.

Expected return

The expected return on a stock investment plus the expected growth in the dividends (= the capitalization rate)

$$\text{Price} = P_0 = \frac{\text{DIV}_1}{r-g}$$
$$\text{Expected return} = r = \frac{\text{DIV}_1}{P_0} + g$$

It relies on a strict assumption of constant dividend growth in perpetuity.
If dividends are expected to grow forever at a constant rate of g

$$P_0 = \frac{\text{DIV}_1}{r-g}$$

Two Stage Discounted Cash Flow

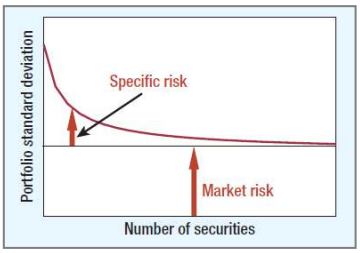
Two-stage DCF is a valuation method that takes into account two stages of expected growth in a company's cash flows. The first stage is a high-growth period, followed by a more stable, long-term growth period. The method involves estimating future cash flows and discounting them back to present value using a discount rate. The result is the estimated fair value of the company's stock.

Portfolio investment and risk

Variance is a statistical measure that represents the average value of the squared deviations of a set of data points from their mean value. It is commonly used as a measure of volatility, where higher variance indicates greater variability and hence greater risk.
To add on, standard deviation is also a commonly used statistical measure of the amount of variation or dispersion of a set of data values. It gives an idea of how spread out the data is from the mean or expected value.
The portfolio rate of return is the weighted average of the rates of return of the individual securities in a portfolio, where the weights correspond to the proportion of the portfolio invested in each security. It is a measure of the overall performance of the portfolio and takes into account the contribution of each security to the portfolio's return.

Portfolio rate of return	=	fraction of portfolio in first asset	×	rate of return on first asset
	+	fraction of portfolio in second asset	×	rate of return on second asset

Diversification: Strategy to reduce risk by spreading the portfolio across many investments.
Unique Risk (diversifiable risk): Risk factors affecting only that firm.
Market Risk (systematic risk): Economy-wide sources of risk that affect the overall stock market.



The variance of a two-stock portfolio is the sum of these four boxes:

	Stock 1	Stock 2
Stock 1	$x_1^2\sigma_1^2$	$x_1x_2\sigma_{12} = x_1x_2\rho_{12}\sigma_1\sigma_2$
Stock 2	$x_1x_2\sigma_{12} = x_1x_2\rho_{12}\sigma_1\sigma_2$	$x_2^2\sigma_2^2$

x= portion , s=standard deviation
Standard deviation= √variance

$$\text{Expected portfolio return} = (x_1 r_1) + (x_2 r_2)$$

= (Asset 1 Weight x Expected Return) + (Asset 2 Weight x Expected Return)

Market portfolio

The market portfolio is a theoretical portfolio that contains all assets in the economy, and it is often used as a benchmark for investors to measure the performance of their own portfolios.
Beta is a measure of a stock's volatility in relation to the overall market. It measures the sensitivity of the stock's returns to changes in the market returns. A beta of 1 indicates that the stock moves in line with the market, while a beta greater than 1 indicates that the stock is more volatile than the market, and a beta less than 1 that the stock is less volatile than the market.

$B_i = \frac{\sigma_{im}}{\sigma_m^2}$ sim= covariance with the market, s^2m= variance of the market.

Derivatives securities markets

A derivative is a financial security whose payoff is linked to another, previously issued security, and it involves the transfer of risk. In many derivatives, two parties agree to exchange a standard quantity of an asset at a predetermined price at a specific date in the future.
These transfers should not have adverse impact as they allow individuals who want to bear risk to take more risk, and those who want to avoid it to transfer it elsewhere.
Derivatives are leveraged instruments, meaning they allow investors to control a large amount of assets with a small amount of money. They are used for:

- Speculation: Buying or selling a derivative contract in order to earn a leveraged rate of return, the rate of return on an investment that has been financed with borrowed money.
- Hedging: Hedging is a technique used to reduce risk in investments. It involves taking a counteracting position in a different security or financial instrument to offset the risk of the original investment. The goal is to minimize potential losses due to market fluctuations and protect the investment.

Waves of derivatives markets:

1. Foreign currency futures
2. Interest rate derivative securities
3. Credit derivatives: A credit forward is a financial tool used to reduce risk in a loan by hedging against a decline in the credit quality of a borrower. It's a forward agreement that pays a predetermined amount if the creditworthiness of the borrower decreases.

Contracts:
Spot contract: financial agreement for immediate delivery and payment of an asset at the current market price. It allows for buying or selling an asset right away, without waiting for a future delivery or price. Spot contracts are used for taking advantage of market movements or reducing price risks.
Forward contract: financial agreement between two parties to buy or sell an asset at a predetermined price and date in the future. It allows investors to lock in a price for an asset today, even if the delivery and payment will take place at a later date, it can be on a specified interest rate rather than an asset, and It is nonstandardized as it is negotiated in the trade.
Futures contract: financial agreement to buy or sell an asset at a predetermined price and date in the future. It is a type of standardized forward contract that is traded on a regulated exchange, so it is more regulated and provides greater liquidity, but also has margin requirements and lower credit risk wrt forward contract.

Future markets

Futures contracts are traded on exchanges through an open-outcry auction where traders face each other and verbally offer to buy or sell a stated number of contracts at a stated price. Floor brokers represent the public as intermediaries, professional traders trade for themselves, position traders take positions based on price expectations for their own accounts, day traders liquidate positions by the end of the day, and scalpers take short-term positions for quick profits. The availability of futures contracts and their trading activity are determined by a variety of factors, including price volatility and trading interest.
Derivatives exchanges operate in a highly competitive market and are under constant pressure to increase profitability and stay ahead of the competition, which can lead to mergers.
Electronic trading is becoming more popular for derivative trading.

Futures Contract Terms

Underlying unit—one U.S. Treasury note having a face value at maturity of $100,000.
Deliverable grades—U.S. Treasury notes with a remaining term to maturity of at least 6½ years, but not more than 10 years, from the first day of the delivery month. The invoice price equals the futures settlement price times a conversion factor, plus accrued interest. The conversion factor is the price of the delivered note ($1 par value) to yield 6 percent.
Price quote—points ($1,000) and halves of 1/32 of a point. For example, 126-16 represents 126 16/32 and 126-165 represents 126 16.5/32. Par is on the basis of 100 points.
Tick size (minimum fluctuation)—one-half of one thirty-second (1/32) of one point ($15.625, rounded up to the nearest cent per contract), except for intermonth spreads, where the minimum price fluctuation will be one-quarter of one thirty-second of one point ($7.8125 per contract).
Contract months—the first three consecutive contracts in the March, June, September, and December quarterly cycle.
Last trading day—seventh business day preceding the last business day of the delivery month. Trading in expiring contracts closes at 12:01 p.m. on the last trading day.
Last delivery day—last business day of the delivery month.
Delivery method—Federal Reserve book-entry wire-transfer system.
Settlement—U.S. Treasury Futures Settlement Procedures.
Position limits—current position limits.
Trading hours (all times listed are central time)—Sunday–Friday: 5:00 p.m.–4:00 p.m. with a 60-minute break each day beginning at 4:00 p.m.
Ticker symbol—CME ClearPort—21; Clearing—21; CME Globex—ZN
Exchange rule—these contracts are listed with, and subject to, the rules and regulations of the CBOT.

- A long position is the purchase of a futures contract.
- A short position is the sale of a futures contract.
- A clearinghouse is an organization that oversees the trading of futures and options contracts on an exchange. It acts as a central counterparty, settling trades and guaranteeing that both parties in a trade fulfill their obligations.
- Open interest is the total number of the futures or option contracts outstanding at the beginning of the day.

A long position in a T-Bond future profits when interest rates decrease, causing the T-Bond value to increase. A short position profits when interest rates rise, causing the T-Bond value to decrease. If interest rates move in the unexpected direction, the future position incurs losses.
An initial margin is a deposit required on futures trades to ensure that the terms of the contracts will be met, its amount varies according to the type of contract traded and minimum levels are set by each exchange.
When a futures trader takes a position, he must keep a certain amount of funds in his margin account as a maintenance margin. If the trader's losses cause his account funds to fall below the maintenance margin, he must deposit additional funds into his margin account to keep the position open. Essentially, the maintenance margin is the minimum amount of funds a trader must keep in his account to ensure that he can cover potential losses in his futures position.

Options

An option is a contract that gives the holder the right, but not the obligation, to buy or sell an underlying asset at a predetermined price during a specified period.
A call option is a contract that gives the buyer the right to buy an underlying security at a predetermined price (strike price). The buyer pays an upfront fee called the call premium to the seller. If the underlying security's price is higher than the strike price, the buyer can exercise the option, buying the security at the strike price and selling it at the current market price. If the underlying security's price is lower than the strike price, the buyer will not exercise the option, and the option will expire unexercised. The buyer loses the call premium, and no other cash flows result. For a call option, the possibility of gain is virtually infinite, while loss is fixed.

A put option is a contract that gives the buyer the right to sell an underlying security at a predetermined price to the option seller. The buyer pays an upfront fee called the put premium to the seller. If the underlying security's price is lower than the exercise price (in the money), the buyer can exercise the option, selling the security at the higher strike price. If the underlying security's price is higher than the strike price (out of the money), the buyer will not exercise the option, and the option will expire unexercised. The buyer loses the put premium, and no other cash flows result. For a put option, the possibility of low is virtually infinite, while gain is fixed.
Traders use call options when they think the price of the underlying asset will rise and put options when they think the price will fall. Both call and put options can be bought and sold on options exchanges.
If the option remains unprofitable (out of the money), the buyer can let it expire without exercising. If the option becomes profitable (in the money), the buyer can exercise the option or sell it to someone else. The option can be exercised before or on the expiration date for an American option, but only on the expiration date for a European option.
The Black-Scholes option pricing model is used to price and value options. It takes into account the spot price of the underlying asset, the exercise price, the exercise date, the volatility of the underlying asset, and the risk-free interest rate.
The time value of an option is the value associated with the probability that the stock price could increase between the option's purchase and expiration date. The time value depends on the price volatility of the underlying asset and the time until the option matures. Higher price volatility and longer time to maturity increase the chance of a price increase. The owner of a call option benefits from price increases but has limited downside risk since the loss of value cannot exceed the call premium. Therefore, the greater the price volatility and time to maturity, the greater the time value of the option. The time value of an option decreases as it moves closer to its expiration date. However, it is the time value that allows an out-of-the-money option to have value and trade in the options market. A call option is out of the money when the exercise price is greater than the current market price of the underlying asset. It can still have a positive premium if investors believe that the stock price might increase before the option's expiration date. The time value of an option can be calculated by subtracting its intrinsic value (difference between the current market price of the underlying asset and the exercise price) from its premium.
The risk-free rate of interest affects the value of an option in two ways:

1. as the risk-free rate increases, the growth rate of the stock price increases, which tends to increase the price of a call option but decrease the price of a put option.
2. the present value of any future cash flows received by the option holder decreases, which tends to decrease the price of both call and put options.

The first effect dominates for call options, so their price always increases as the risk-free rate increases. However, both effects tend to decrease the value of put options, so their price decreases as the risk-free rate increases.
A stock option is based on a company's stock, while a stock index option is based on a stock market index. Futures options are based on futures contracts. The value of a credit spread call option increases as the risk premium or yield spread on a specified benchmark bond of the borrower increases. A digital default option pays a set amount in the event of a loan default.

Swaps

A swap is an agreement between two parties to exchange cash flows at specified intervals for a specific period of time. A plain vanilla interest rate swap involves exchanging fixed-interest payments for floating-interest payments between two parties, with the buyer making the fixed payments and the seller making the floating payments. There is no exchange of principal in this transaction. The swap contract therefore, can be seen as a series of forward contracts.
Swaps are heavily traded financial contracts, with a total amount of over $348 trillion outstanding in 2010.
A Major Swap Participant (swap bank) is a financial institution that facilitates swaps, serving as a broker or dealer. Swap banks can be international commercial banks, investment banks, or independent operators. As a broker, they match counterparties but don't assume any risk. As a dealer, they assume a position in the swap and receive a portion of the cash flows passed through them for bearing risk.

A currency swap is a financial tool used to manage the risk of exchanging different currencies on assets and liabilities. It involves exchanging payments in different currencies at a known exchange rate. Like interest rate swaps, currency swaps are motivated by comparative advantage and help match cash flows in different currencies.
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Credit default swaps (CDS) are contracts that allow investors to transfer credit risk to another party. A CDS is an agreement where one party agrees to pay the other party if a borrower defaults on a loan. CDSs are often used by lenders to hedge their credit risk. They are traded over-the-counter and are customized between the parties involved, making them hard to track for regulators; they are similar to insurance policies.
A total return swap is an agreement to exchange the total return on a loan or an asset for a fixed or floating rate payment. It can be used to hedge credit exposure but carries interest rate risk as well. In a pure credit swap, a lender pays a fixed fee or premium to a counterparty as insurance against loan defaults. Example: Let's say that Investor A owns a portfolio of stocks and wants to receive the total return on that portfolio. Investor B, on the other hand, is willing to pay a fixed rate in exchange for receiving the total return on Investor A's portfolio. They enter into a total return swap agreement where Investor A receives fixed payments from Investor B, and in exchange, Investor B receives the total return on the portfolio. This allows Investor A to hedge their exposure to the portfolio while Investor B gains exposure to the underlying assets without actually owning them.
Swaps are customizable contracts and not standardized. Swap dealers, typically financial institutions, maintain liquidity in the markets by matching counterparties or taking positions themselves. Swap markets were previously less regulated than futures and options markets, but the International Swaps and Derivatives Association (ISDA) sets codes of standards for swap documentation among 56 countries.
Options on interest rates are used by financial institutions to hedge interest rate risk. Caps are call options on interest rates and floors are put options on interest rates, both of which have multiple exercise dates. Collars involve simultaneously buying a cap and selling a floor.

Black-Scholes Option Pricing Model

$$C = N(d_1)S - E(e^{-rT})N(d_2)$$

$$d_1 = \frac{\ln(S/E) + (r + \sigma^2/2)T}{\sigma\sqrt{T}}$$
$$d_2 = d_1 - \sigma T$$

C= call premium
S= current stock price
T= time until option exercise
E= option striking price
r= risk free interest rate
N= cumulative standard normal distribution
e= exponential term
s= standard deviation
ln=natural log

For doubts or suggestions on the handout:

BENEDETTA BURSTON

+39 3333685542

@benedettaburston

For info about our teaching division:

GIOVANNI BARBARO

+39 3277175240

@gianni_barbaro2

CARLOTTA CAROMANI

+39 3703723764

@carlottacaromani