

Table of Contents

Corporate Finance	3
Corporate Organization	3
The Agency Problem	4
Financial Statements	6
The Balance Sheet	6
The Income Statement	7
Taxes	8
Financial Analysis	8
Financial Ratios	10
Ratio Analysis	10
Financial Models	14
Growth Rates	15
Capital Investment	17
The One Period Case	17
The Multiperiod Case	17
Compounding Periods	18
Simplifications	18
Investment Rules	19
Capital Budgeting	22
Types of Costs	22
Sensitivity Analysis	22
Monte Carlo Simulations	23
Bonds	25
Bond Features	25
Bond Yield Determinants	26
Stocks	27
Stock Valuation	27
The Dividend Discount Model	27
Growth Opportunities	28

The Minimum Variance Portfolio	28
Risk-Free Investment	28

Corporate Finance

Corporate Organization

- The corporate firm is intended to organize the economic activity of many individuals
- The Sole Proprietorship
 - This is a business owned by a single individual
 - Pros:
 - Cheapest to form
 - Few government regulations to satisfy
 - No corporate income taxes
 - Cons:
 - Unlimited liability for business debts and obligations
 - No distinction between personal and business assets
 - Life is limited by the life of the owner
 - Equity is limited to the proprietor's personal contributions
- The Partnership
 - This is a business owned by multiple individuals
 - 2 types:
 - General Partnership
 - Partners agree to provide some fraction of the work and cash and to share profits and losses
 - Each partner is liable for *all* debts of the partnership
 - Limited Partnership
 - Liability of some of the partners is limited to the amount of cash they've contributed
 - At least 1 general partner
 - Limited partners have no role in managing the business
 - Pros:
 - Inexpensive to form
 - Limited partners have the freedom to sell their interest in a business
 - No corporate income taxes
 - Management is simple and relies on the general partners
 - Cons:

- General partners still have unlimited liability for all debts
 - Difficult to transfer ownership without dissolving
 - Difficult to raise large amounts of cash
- The Corporation
 - This is a business acting as a distinct legal entity
 - 3 sets of distinct interests: shareholders, directors, and officers
 - Shareholders control the corporation's direction and policies, while electing directors
 - Directors appoint the officers
 - Officers manage the operations of the corporation
 - Pros:
 - Easily transferable ownership
 - Unlimited lifespan, disconnected from owners => perpetual succession
 - Liability limited to the amount invested in the ownership shares
 - Cons:
 - More complicated to start
 - Diversified interests result in conflicting decision making
 - Subject to extra taxes on corporate income
- The Limited Liability Company (LLC)
 - An entity that is taxed like a sole proprietorship/partnership, but provides limited liability for owners
 - Subject to certain conditions set by the IRS
- Other corporate structures include the joint-stock company, public limited company, etc.
- Going Public
 - Pros:
 - Obtain money that does not have to be repaid
 - Increased visibility
 - Market valuation
 - Cons:
 - Going public is costly
 - Management loses some of its freedom to act without board approval
 - Open to scrutiny
 - Public reporting

■ Risk of takeover

The Agency Problem

- The big question is: will management pursue its own goals at the shareholders' expense
- The agency relationship is the relationship between stockholders and management
- The agency problem is the possibility for a conflict of interest between the principal and the agent
 - The costs of this conflict of interest are known as agency costs, and can be indirect or direct
 - The agent will tend to maximize the amount of power and wealth they control, leading to overemphasizing growth and corporate size
 - Dependent on 2 factors: how closely aligned are the goals of the principal and the agent, and can the agent be replaced by the principal
 - The agent will tend to have financial incentive to align their goals, as their salaries and job prospects are tied to their success at promoting the interests of the principal
 - The agent will tend to be under the control of the principal's hiring and firing
 - Poor management acts as a sign that the firm is a valuable takeover target
- Stockholders are intended to control the firm and the maximization of their wealth should be the primary goal of the corporation

Basis of Corporate Finance

- Answer 3 questions:
 - What long-term investments should the firm choose?
 - Capital budgeting
 - How should the firm raise funds for the selected investments?
 - Capital structure
 - How should short-term assets be managed and financed
 - Net working capital

Financial Statements

The Balance Sheet

- This is an accountant's snapshot of a firm's accounting value on a particular date
- Balance sheets are split into 2 sides: assets and liabilities
- By definition of the balance sheet, the amount of assets (LHS) must be equal to the amount of liabilities plus the amount of equity (RHS)
 - Stockholders' equity is defined to be the difference between assets and liabilities of the firm, as stockholders are left with this equity once the firm has satisfied its obligations
 - Money coming into the funding side must be used on the assets side
- Assets (LHS)
 - Things that the company owns
 - Split into current assets and fixed assets
 - Current Assets
 - Assets that can be converted into cash in a short amount of time (1 year)
 - Cash, accounts receivable, inventory, etc.
 - Related to net working capital
 - Fixed Assets
 - Assets that cannot or not intended to be readily converted into cash without major loss of value
 - Can be further split into tangible and intangible assets
 - Related to capital budgeting
- Funding (RHS)
 - Split into current liabilities, long-term liabilities, and shareholders' equity
 - Related to capital structure
 - Current Liabilities
 - Short-term borrowing, liabilities that must be paid in one year
 - Accounts payable, notes payable, etc.
 - Related to net working capital
 - Long-Term Liabilities

- Long-term borrowing, liabilities that will be paid in over a year
 - Deferred taxes, long-term debt, etc.
- Shareholders' Equity
 - The money the owners have put into the company
 - Stock, capital surplus, retained earnings, etc.
- 3 primary concerns: liquidity, debt vs. equity, and value vs. cost
 - Liquidity
 - This is the ease at which assets can be converted into cash without significant loss in value
 - In order from most liquid to least liquid:
 - Current assets - cash and assets that can be converted into cash within a year
 - Accounts receivable - amounts not yet collected from customers for goods or services sold to them
 - Inventory - raw materials to be used in production, work, and finished goods
 - Fixed assets - tangible and intangible assets not usually intended to pay off expenses
 - Directly correlates with a firm's ability to meet their short-term obligations
 - A higher liquidity involves sacrificing potential profit, as liquid assets tend to have lower rates of return than fixed assets
 - Debt vs. Equity
 - Debt and equity are the 2 ways a firm can finance its activities
 - Debt comes in the form of liabilities - obligations of the firm that require a payout within a predefined period
 - Failure to make a payment puts the firm in default of a contract
 - Bonds
 - Equity - claim against the firm's assets that is residual and not fixed
 - Includes the retained earnings of the firm, which increase the firm's accounting value
 - Value vs. Cost

- Book value - the accounting value of a firm's assets
 - Market value - the price at which buyers and sellers would trade assets
 - Financial statements carry assets at cost by GAAP
 - The goal of management is to create value for the firm that exceeds its cost
- Net Working Capital
 - Defined as the difference between current assets and current liabilities
 - Should usually be expected to be positive, especially over a long period of time
 - Operating at negative NWC and at a loss forces the company to rely on their future potential to survive through equity
 - Growing firms tend to have positive change in NWC

The Income Statement

- The income statement measures performance over a specific period
- Income is defined as the difference between revenue and expenses
- Several sections:
 - The operations section reports the firm's revenues and expenses from principal operations
 - This is the firm's EBIT
 - The non-operating section includes financing costs
 - The final item is the net income
- Noncash Items
 - These items contribute to the accounting income, but do not actually exist within the firm's cash flow
 - Depreciation - a reflection of the accountant's estimate of the cost of equipment used in the production process
 - Amortization - a reflection of the accountant's estimate of the cost of intangible assets used in the production process
 - Deferred taxes - the result from the difference between accounting income and taxable income
- Time and Costs
 - The future is split into two sections: the short run and the long run
 - Short-run

- This is the period in which certain equipment, resources, and commitments are fixed
- Output can be varied
- Forced to distinguish between fixed and variable costs
 - Fixed costs have fixed commitments and don't change in the short term
 - Variable costs change as the output of the firm changes
- Long-run
 - This is the period in which all costs are variable
 - Forced to distinguish between product costs and period costs
 - Product costs are the total production costs incurred during a period, appearing on the income statement as COGS
 - Period costs are costs that are allocated to a time period

Taxes

- The size of a firm's tax bill is determined by the tax code, which is influenced by political, not economic, forces
- We must differentiate between average and marginal tax rates
 - Average tax rates are the firm's tax bill divided by the firm's taxable income
 - In other words, this is the percentage of your income that goes to pay taxes
 - Marginal tax rates are the tax you would pay if you earned 1 more dollar
 - These tell us the marginal effect of a decision on the firm's tax bill
 - In a flat-rate tax, only 1 tax bracket exists, resulting in the marginal tax rate being equal to a firm's average tax rate

Financial Analysis

- Direct comparisons of financial statements are almost impossible due to varying sizes of companies

- Common-size statements – statements created by converting existing financial statements from dollars to percentages
 - Balance sheets
 - The total change must be 0 since all numbers must add up to 100%
 - Income statements
 - Net income
 - Reflects differences in a firm's capital structure, taxes, and operating income
 - Relates closely to dividend payout and retained earnings
 - Earnings per share (EPS)
 - The net income expressed on a per share basis
 - Defined as the net income divided by the number of shares outstanding
 - Earnings before interest expense and taxes (EBIT)
 - Income before items outside of the principal operations of the firm
 - Defined as the difference between operating revenues and operating income
 - Earnings before interest expense, taxes, depreciation, and amortization (EBITDA)
 - Defined as the sum of EBIT, depreciation, and amortization
 - Gives us what happens to each dollar in sales

Financial Ratios

Ratio Analysis

- These are ways of comparing and investigating the relationships between different pieces of financial information
- Their computation isn't standardized, leading to confusion
- 5 types of ratios: liquidity ratios, financial leverage ratios, asset management/turnover ratios, profitability ratios, and market value ratios
 - Liquidity Ratios
 - Provides information about a firm's liquidity
 - As a result, these focus on the firm's current assets and liabilities
 - Keep in mind that these values may not be a reliable indicator for future success
 - Current Ratio:
 - $$\frac{\text{Current Assets}}{\text{Current Liabilities}}$$
 - Basic measure of short-term liquidity
 - Is generally greater than 1 for healthy firms
 - A current ratio of less than 1 is indicative of a negative NWC
 - Large companies with large reserves of borrowing power may have lower current ratios
 - Quick Ratio
 - $$\frac{\text{Current Assets} - \text{Inventory}}{\text{Current Liabilities}}$$
 - Takes into account that inventory is the least liquid current asset
 - Large inventories may indicate the struggle of a business
 - Using cash to buy inventory keeps the current ratio constant, but lowers the quick ratio
 - Cash Ratio
 - $$\frac{\text{Cash}}{\text{Current Liabilities}}$$
 -

- Typically only interesting to very short-term creditors
- Financial Leverage Ratios
 - Addresses the firm's long-run ability to meet its obligations
 - Known as the firm's financial leverage
 - Total Debt Ratio
 - $$\frac{\text{Total Assets} - \text{Total Equity}}{\text{Total Assets}}$$
 -
 - Takes into account all of the firm's debts
 - Can be broken down into 2 variations:
 - Debt-Equity Ratio
 - $$\frac{\text{Total Debt}}{\text{Total Equity}}$$
 -
 - Equity Multiplier
 - $$\frac{\text{Total Assets}}{\text{Total Equity}}$$
 -
 - Both variations and the total debt ratio can be used to calculate one another
 - Times Interest Earned (TIE)
 - $$\frac{\text{EBIT}}{\text{Interest}}$$
 -
 - Measures how well a company has its interest obligations covered
 - Must be aware that EBIT isn't an accurate representation of cash available
 - Cash Coverage
 - $$\frac{\text{EBITDA}}{\text{Interest}}$$
 -
 - Solves the issues with TIE
- Asset Management/Turnover Ratios
 - Can be interpreted as how efficiently a firm uses its assets to generate sales
 - Inventory Turnover
 - $$\frac{\text{COGS}}{\text{Inventory}}$$
 -
 - Measures how fast a firm sells products
 - A higher inventory turnover means a more efficient management of inventory
 - Days' Sales in Inventory

- $$\frac{365 \text{ Days}}{\text{Inventory Turnover}}$$
 - Inventory Turnover
 - Representative of how long it takes to turnover the inventory on average
 - Receivables Turnover
 - $$\frac{\text{Sales}}{\text{Accounts Receivable}}$$
 - Accounts Receivable
 - A measure of how fast a firm collects on its sales
 - Days' Sales in Receivables
 - $$\frac{365 \text{ Days}}{\text{Receivables Turnover}}$$
 - Receivables Turnover
 - Representative of the firm's average collection period (ACP)
 - Total Asset Turnover (TAT)
 - $$\frac{\text{Sales}}{\text{Total Assets}}$$
 - Total Assets
- Profitability Ratios
 - Measures how efficiently a firm uses its assets and manages its operations
 - Profit Margin
 - $$\frac{\text{Net Income}}{\text{Sales}}$$
 - Sales
 - EBITDA Margin
 - $$\frac{\text{EBITDA}}{\text{Sales}}$$
 - Sales
 - Focuses more on operating cash flows, ignoring the effects of capital structure and taxes
 - A high value translates to lower expense ratios relative to sales
 - Return on Assets (ROA)
 - $$\frac{\text{Net Income}}{\text{Total Assets}}$$
 - Total Assets
 - Measures profit per dollar of assets
 - Based on book assets/equity
 - Return on Equity (ROE)
 - $$\frac{\text{Net Income}}{\text{Total Equity}}$$
 - Total Equity
 - Measures stockholder success over the year

- Generally used as the bottom-line measure of performance
 - Based on book assets/equity
- Market Value Ratios
 - Based on information outside of financial statements
 - Specifically, the market price per share of the stock, which is only accessible for publicly traded companies
 - Price-Earnings Ratio

$$\frac{\text{Price Per Share}}{\text{Earnings Per Share}}$$
 - Measures how much investors are willing to pay per dollar of current earnings
 - A higher price-earnings ratio implies more potential for future growth
 - Market-to-Book Ratio

$$\frac{\text{Market Value Per Share}}{\text{Book Value Per Share}}$$
 - Compares the market value of the firm's investments to their cost
 - Values less than 1 mean that the firm has been unsuccessful in creating value for stockholders
 - Market Capitalization
 - $\text{Market Price Per Share} \times \text{Number of Shares Outstanding}$
- Enterprise Value
 - $\text{Market Capitalization} + \text{Market Value of Interest Bearing Debt} - \text{Cash}$
 - Used to better estimate how much it would take to buy all of the outstanding stock of a firm and pay off debts
- Enterprise Value Multiples

$$\frac{\text{EV}}{\text{EBITDA}}$$
 - Allows for the comparison of firms when they have differing capital structures, taxes, or capital spending
 - Will be high for firms with high growth opportunities
- The DuPont Identity
 - $\text{ROE} = \text{Profit Margin} \times \text{Total Asset Turnover} \times \text{Equity Multiplier}$
 - This tells us that ROE is affected by three things:
 - Operating efficiency => profit margin

- Asset-use efficiency => total asset turnover
- Financial leverage => equity multiplier

Financial Models

- These models output pro forma financial statements
- We use financial statements to summarize the projected future financial status of a company
- The Percentage of Sales Approach
 - The basic idea is to separate the balance sheet and income statement accounts into 2 groups: those that vary with sales and those that don't
 - We use this along with a sales forecast to calculate the amount of financing a firm will need to support the sales level
 - Income statements
 - Assume that the profit margin is constant, meaning that costs are a constant percentage of sales
 - Dividend Payout Ratio
 - $d = \frac{\text{Cash Dividends}}{\text{Net Income}}$
 - Retention Ratio
 - $b = \frac{\text{Addition to Retained Earnings}}{\text{Net Income}}$
 - By definition:
 - $b + d = 1$
 - Everything that isn't paid out as dividends is kept in the firm as retained earnings
 - Balance sheets
 - We assume that some items vary directly with sales and others don't
 - For those that vary with sales, we express them as a percentage of sales for the year
 - Capital Intensity Ratio
 - Defined as the ratio of total assets to sales
 - Tells us the amount of assets needed to generate a dollar in sales
 - This is mathematically the reciprocal of the TAT

■ External Financing Needed

- $\frac{\Delta \text{Sales}}{\text{Sales}} (\text{Assets} - \text{Spontaneous Liabilities}) - \text{PM} \times \text{Projected Sales} \times (1 - d)$
- Based on 3 parts:
 - The projected increase in assets => capital intensity ratio
 - The spontaneous increase in liabilities
 - The projected net income times the retention ratio => projected addition to retained earnings
- Increases with a higher rate of growth in sales or assets

Growth Rates

- Internal Growth Rate
 - The maximum growth rate that can be achieved with no external financing
 - $\text{EFN} = 0$
 - $\text{IGR} = \frac{\text{ROA} \times b}{1 - \text{ROE} \times b}$
- Sustainable Growth Rate
 - The maximum growth rate that can be achieved with no external equity financing while maintaining a constant debt-equity ratio
 - $\text{SGR} = \frac{\text{ROE} \times b}{1 - \text{ROE} \times b}$
 - Illustrates the explicit relationship between a firm's operating efficiency (PM), asset-use efficiency (TAT), dividend policy (b), and financial policy (DE ratio)
- Growth Factors
 - There are 4 factors that the firm's ability to grow is dependent on:
 - Profit margin - an increase in profit margin increases the firm's ability to generate funds internally
 - Dividend policy - a decrease in dividend payout ratio will increase the firm's retention ratio, increasing the firm's ability to generate funds internally
 - Financial policy - an increase in the firm's debt-equity ratio increases its financial leverage, increasing the firm's ability to generate funds externally

- Total asset turnover - an increase in the firm's TAT increases the sales generated for each dollar in assets, decreasing the firm's need to acquire new assets in order to grow

Capital Investment

The One Period Case

- The future value is defined as the value of a sum after investing over one or more periods
- The present value is the amount of money required to be invested to get a specific return in the future
 - $PV = \frac{C_1}{1 + r}$
 - The rate of return, r , is called the discount rate
 - More risk leads to a higher discount rate
- Future and present value analysis will always lead to the same decision
- Net present value is defined as the present value of future cash flows minus the present value of the cost of the investment
 - $NPV = -\text{Cost} + PV$

The Multiperiod Case

- Compounding is the process of leaving money in the financial market and lending it for another year
 - Simple interest is interest times a constant, and is not reinvested
 - Interest of interest is exponential interest that is reinvested
 - Cash is invested at compound interest, where each interest payment is reinvestment
 - $FV = C_0 \times (1 + r)^T$
- Discounting is process of calculating the present value of a future cash flow
 - This is the opposite of compounding
 - The present value factor is the factor used to calculate the present value of a future cash flow
 - $PV = \frac{C_T}{(1 + r)^T}$
- The NPV of a T-period project is calculated by:
 - $NPV = -C_0 + \sum_{i=1}^T \frac{C_i}{(1 + r)^i}$

Compounding Periods

- Compounding an investment m times a year provides an end-of-year wealth equal to:

- $C_0 \left(1 + \frac{r}{m}\right)^m$

- The annual rate of return is called the effective annual rate (EAR)

- $\text{EAR} = \left(1 + \frac{r}{m}\right)^m - 1$

- Stated Annual Interest Rate vs. Effective Annual Rate

- SAIR is meaningful only if the compounding interval is given
 - EAR is meaningful without a compounding interval
 - Tells you directly how much a dollar will net you in a year

- Compounding Periods

- Future value with compounding

- $\text{FV} = C_0 \left(1 + \frac{r}{m}\right)^{mT}$

- Continuous Compounding

- The act of compounding every infinitesimal instant

- $C_0 \times e^{rT}$

Simplifications

- Perpetuity

- Defined as a constant stream of cash flows without end
 - The present value of the consol is the present value of all of its future coupons

- $\text{PV} = \frac{C}{1+r} + \frac{C}{(1+r)^2} + \dots = \frac{C}{r}$

- Growing Perpetuity

- Defined as a cash flow stream that is assumed to rise indefinitely

- $\text{PV} = \frac{C}{1+r} + \frac{C \times (1+g)}{(1+r)^2} + \dots + \frac{C \times (1+g)^{N-1}}{(1+r)^N} = \frac{C}{r-g}$

- 3 important points:

- The numerator - represents the cash flow one period hence, not at date 0
 - The discount rate and growth rate - r must be greater than g for the formula to work, behavior is undefined otherwise

- The timing assumption - a regular and discrete pattern of cash flow is assumed
- Annuity
 - Defined as a level stream of regular payments that lasts for a fixed number of periods
 - $$PV = \frac{C}{1+r} + \frac{C}{(1+r)^2} + \dots + \frac{C}{(1+r)^T}$$
 - The term we use to compute the present value of the stream of level payments, C, is known as the annuity factor
 - $$FV = C \left[\frac{(1+r)^T - 1}{1r} \right]$$
 - Important points to consider:
 - Delayed annuities - the formula derives the present value of the annuity as of one period prior to the first payment
 - Annuity due - formulas assume that the first annuity payment begins a full period hence
 - The infrequent annuity - an annuity with payments occurring less frequently than once a year
 - Equating present value of two annuities
- Growing Annuity
 - Defined as a finite number of growing cash flows
 - $$PV = C \left[\frac{1}{r-g} - \frac{1}{r-g} \times \left(\frac{1+g}{1+r} \right)^T \right] = C \left[\frac{1 - \left(\frac{1+g}{1+r} \right)^T}{r-g} \right]$$

Investment Rules

- The NPV Rule
 - NPV analysis focuses on the decision-making process for accepting or rejecting projects
 - The NPV Rule can be generalized to:
 - Accept a project if the NPV is greater than 0
 - Reject a project if the NPV is less than 0
 - Accepting positive NPV projects benefits the stockholders
 - Value additivity is defined as the sum of the values of the different projects, divisions, or other entities of the firm
 - This implies that the contribution of any project to a firm's value is simply the NPV of the project

- There are 3 important attributes of NPV
 - NPV uses cash flows
 - Don't use earnings, as they are a construct of accounting and don't properly represent cash
 - Real cash flows can be used for other corporate purposes
 - NPV uses *all* the cash flows of the project
 - Other approaches ignore cash flows beyond a particular date
 - NPV discounts the cash flows properly
 - Other approaches ignore the time value of money
- The Payback Period Method
 - The payback period is defined as the amount of time it takes for a firm to recover its investment
 - The payback period rule for making investment decisions involves selecting a cutoff date and evaluating if the payback period falls within that cutoff data
 - Accept the project if it does
 - Reject the project if it doesn't
 - Pros:
 - Simple and fast to calculate
 - Good for minor decisions
 - May be accurate for firms low on current assets that need to regain their investment quickly
 - Easy for evaluation purposes
 - Cons:
 - The timing of cash flows is not accounted for properly
 - All cash flows after the cutoff period are ignored, resulting in some positive NPV projects to be rejected
 - The cutoff date is somewhat arbitrary
- The Discounted Payback period Method
 - Method that acts as a variation of the payback period method, but first discounts the cash flows
 - Ends up being a poor compromise between the NPV rule and payback period method that takes on the cons of both
- Profitability Index

- Defined as the ratio of the present value of the future expected cash flows after initial investment divided by the amount of initial investment
- Independent Projects
 - Follows NPV ruling
 - the PI decision rule states that if the PI is greater than 1, we accept the project, otherwise, we reject it
 - If NPV is positive, the PI will be greater than 1, resulting in the project being accepted
- Mutually Exclusive Projects
 - PI begins to suffer from the fact that it doesn't account for the size of the projects
 - May possibly pick the project with the lower NPV
- Capital Rationing
 - Defined as the case where the firm doesn't have enough capital to fund all possible positive NPV projects
 - A firm may prefer to rank them by the PI rule instead of the NPV rule

Capital Budgeting

Types of Costs

- In the consideration of a single project, we discount cash flows, not earnings
- In the consideration of the firm as a whole, we discount dividends, not earnings
- Only cash flows that occur as a direct consequence of accepting the project should be used
- A sunk cost is defined as a cost that has already occurred
 - These shouldn't be taken into account in capital budgeting decisions
- An opportunity cost is defined as lost revenue that results from using assets in a project over other alternatives
 - These should be meaningfully viewed as a cost to the project, as the firm forgoes other opportunities
- Side Effects
 - Erosion occurs when a new product reduces the sales and cash flows of existing products
 - Synergy occurs when a new product increases the sales and cash flows of existing products
- An allocated cost is defined as a cost that is used for the project, but would exist even without the project's existence
 - These shouldn't be taken into account in capital budgeting decisions

Sensitivity Analysis

- Sensitivity analysis examines how sensitive a particular NPV calculation is to changes in underlying assumptions
 - Generally related to revenues and costs
 - Revenue concerns include the market share, size of the market, price per unit, etc.
 - Cost concerns include variable costs and fixed costs
- Sensitivity analysis calls for the NPV calculation of pessimistic, expected, and optimistic possibilities of a single variable, in addition to the expected forecast of all other variables

- Areas that are more impacted by this change in forecast may indicate more information is needed
- Cons:
 - May increase the false sense of security among managers, as the eventual outcome may be worse than the pessimistic projection
 - Variables are likely to be dependent on one another, despite being treated as individual factors
- Break-Even Analysis
 - Break-even analysis focuses on determining the sales needed to break even
 - Can be calculated in terms of accounting profit and financial profit:
 - Accounting Profit
 - $$\text{BEP} = \frac{\text{Fixed Costs} + \text{Depreciation}}{\text{Sales Price} - \text{Variable Costs}}$$
 - This calculation ignores taxes since the number of units needed to break even on a pretax basis must be equal to the number of units needed to break even on an after-tax basis
 - Companies breaking even on an accounting basis are losing money since they're losing the opportunity cost of the initial investment
 - Financial Profit
 - $$\text{BEP} = \frac{\text{EAC} + \text{Fixed Costs} \times (1 - t_c) - \text{Depreciation} \times t_c}{(\text{Sales Price} - \text{Variable Costs}) \times (1 - t_c)}$$
 - The financial perspective corrects for the fact that depreciation understates the true costs of recovering the initial investment

Monte Carlo Simulations

- These simulations are an attempt to model real-world uncertainty
- Step 1: Specify the basic model
 - Break up the project's cash flow into components
- Step 2: Specify a distribution for each variable in the model
 - Model each component variable over a distribution
 - May need distributions over multiple years
- Step 3: The computer draws one outcome

- Generate a single outcome by making a drawing for each variable in the model, generating a cash flow from the project in each future year
 - Analyze the probability for each outcome to be drawn
- Step 4: Repeat the procedure
 - Repeated trials result in a distribution of cash flow for each future year
- Step 5: Calculate NPV
 - Use the cash flow distribution to determine the expected cash flow for the year and all future years
 - Use this cash flow to calculate the NPV of the project

Bonds

Bond Features

- A bond's principal is repaid in full at the end of the loan, while its coupons are paid out each year
 - The amount paid at the end of the loan is called the bond's face value
- The annual coupon divided by the face value is called the coupon rate on the bond
- The number of years until the face value is paid is called the bond's time to maturity
- The constant nature of bonds relative to market changes results in the value of the bond fluctuating
 - Rising interest rates lead to declining bond values and vice versa
- A bond's yield to maturity is the interest rate required in the market for the bond's value to equal the present value of the bond's future cash flows
 - A bond that sells for less than its face value is a discount bond
 - A bond that sells for more than its face value is a premium bond
 - $\text{Bond Value} = \text{PV of the Coupons} + \text{PV of the Face Value}$
- Interest Rate Risk
 - Interest rate risk depends on the bond's sensitivity to interest rate changes
 - Bonds with longer times to maturity are impacted more by interest changes since they have more time to compound
 - Bonds with lower coupon rates are impacted more by interest changes since the total value of the bond is more reliant on the PV of the bond's face value
 - Interest rate risk increases at a decreasing rate
- Current yield is a bond's annual coupon divided by its price
 - Current yield is low on discounted bonds and high on premium bonds since the built in gains and losses from the return are ignored
- Treasury bonds are a proxy for zero-risk bonds
- The possibility of default generates a wedge between the promised yield and the expected return of a bond

- Promised yield calculations assume the bondholder receives the full face value and ignore the probability of default
- Expected return calculations specifically take the probability of default into account

Bond Yield Determinants

- The Term Structure of Interest Rates
 - Short-term and long-term interest rates will generally be different
 - Is upward sloping if long-term rates are higher than short-term
 - Shape is affected by 3 factors:
 - The real rate of interest
 - The prospect of future inflation
 - Compensation known as an inflation premium is demanded
 - Interest rate risks
 - Compensation known as an interest rate risk premium is demanded
- Bond Yields and the Yield Curve
 - The plot of Treasury yields relative to maturity is called the Treasury yield curve
 - This curve's shape is reflective of the term structure of interest rates
 - Treasury notes and bonds are default free, taxable, and highly liquid
 - The default risk premium is compensation from non-Treasury bond issuers needed due to the risk of default
 - Municipal bonds are tax-free
 - Taxable bonds require the existence of taxability premiums as compensation
 - Investors prefer liquid assets
 - Less liquid bonds require the existence of a liquidity premium as compensation

Stocks

Stock Valuation

- A stock provides 2 cash flows: the dividends paid on a regular basis and the sale price when the stock is sold
 - The price of a stock is equal to both the discounted present value of the sum of next period's dividend plus next period's stock price and the discounted PV of all future dividends

$$P_0 = \frac{\text{Div}_1}{1+R} + \frac{\text{Div}_2}{(1+R)^2} + \frac{\text{Div}_3}{(1+R)^3} + \dots = \sum_{t=1}^{\infty} \frac{\text{Div}_t}{(1+R)^t}$$

- Dividends are expected to follow one of 3 growth patterns: zero growth, constant growth, and differential growth

- Zero Growth

$$P_0 = \frac{\text{Div}}{1+R} + \frac{\text{Div}}{(1+R)^2} + \dots = \frac{\text{Div}}{R}$$

- Constant Growth

$$P_0 = \frac{\text{Div}}{1+R} + \frac{\text{Div}(1+g)}{(1+R)^2} + \frac{\text{Div}(1+g)^2}{(1+R)^3} + \dots = \frac{\text{Div}}{R-g}$$

- Based on a growing perpetuity
- This type of growth is an explicit goal for many companies

The Dividend Discount Model

- The Growth Rate
 - The net investment of a company is equal to total investment minus depreciation
 - The net investment is 0 when these values are equal, representing that the company is simply maintaining its physical plant
 - The net investment is positive if some of the earnings are retained
 - $1+g = 1 + \text{Retention Ratio} \times \text{Return on Retained Earnings}$
 - $g = \text{Retention Ratio} \times \text{Return on Retained Earnings (ROE)}$
 - The estimate for the growth rate in earnings is also the estimate of the growth rate in dividends
- The Total Return

- $R = \frac{\text{Div}}{P_0} + g$
- R has 2 components: the dividend yield and the capital gains yield
 - The Dividend Yield
 - $\frac{\text{Div}}{P_0}$
 - Conceptually similar to the current yield on a bond
 - The Capital Gains Yield
 - g
 - The rate at which the value of the investment grows

Growth Opportunities

- A company that pays out all of its earnings per share as dividends in perpetuity is called a cash cow
 - This isn't optimal for the firm, they likely would want to use some of their earnings to invest in future projects
 - $\frac{\text{EPS}}{R} + \text{NPVGO} = \text{Price Per Share}$
 - NPVGO is the net present value of the growth opportunity, calculated on a per share basis
 - Value is only increased when earnings are retained to fund projects and positive NPV projects are undertaken and
 - Earnings and dividends may still grow, regardless of if a project with a positive or negative NPV is selected
- Retention Ratios
 - If the ROE of a firm is greater than its total return, the NPVGO is positive and increases with the retention ratio
 - If the ROE of a firm is less than its total return, the NPVGO is negative and decreases with an increase in the retention ratio

The Minimum Variance Portfolio

●

Risk-Free Investment

●