FINC2012 Notes

Lecture 1 - Making Investment Decisions with NPV

- **FREE CASH FLOW = OPERATING CASH FLOW**

- CAPITAL EXPENDITURES

- CHANGE IN WORKING CAPITAL REQUIREMENTS

- WHERE **OPERATING CASH FLOW** =
    - Revenue - COGS - Other Costs - Taxes
        - Revenue - Cash Expenses - Taxes
        - EBDIT - Taxes
            - *where Taxes = EBIT (after depreciation!)* $\times$ *Taxation Rate*
    - Profit After Tax + Depreciation
        - Depreciation Tax Shield = Depreciation Costs $\times$ Tax Rate
- **EXCLUDE** SUNK COSTS, FINANCING COSTS, OVERHEAD COSTS INCURRED BY FIRM NOT RELATED TO PROJECT.
- **INCLUDE** SIDE EFFECTS, OPPORTUNITY COSTS, SALVAGE VALUES.

Extra Detail

- **Only cash flow is relevant** i.e. **estimate incremental effect** of a project (changes in firm's cash flows that occur as a direct result of accepting a project). Depreciation is NOT an incremental cash flow.
- Do not use accounting income - NPV requires recognition of cash flow when it actually occurs.
- Working capital summarises the net investment in short-term assets, such as inventory, accounts receivable and accounts payable $\rightarrow$ Current Assets - Current Liabilities
- We analyse the project as if it were all-equity financed, treating all cash outflows as coming from stockholders and all cash inflows as going to them, to separate the analysis of investment and financing decision.

	Note: Inflows have "+" and outflows have "-" signs						
		0	1	2	3	4	5
1	Revenue						
2	(-) Cash/Operating Expenses						
3	(-) Depreciation						
4	Taxable Income						
5	(-) Income Tax Payable						
6	Operating Cash Flow (1-2-5)						
7	(-) Initial Outlay (CAPEX)						
8	(-) Any Maintenance Cost?						
9	Working Capital Requirements						
10	(-) Change in Working Capital						
11	Salvage Value						
12	(-) Tax on Salvage						
13	Any Opportunity Cost? (after tax)						
14	Any Side Effect? (after tax)						
	Net Cash Flow						
	R						
	NPV						

- Take care with inflation. Match nominal with nominal, real with real.

$$(1+r_n) = (1+r_r)(1+\rho)$$

$$\text{Real Discount Rate} = \frac{1+\text{Nominal Discount Rate}}{1+\text{Inflation Rate}} - 1$$

- Where real figures are given, nominal discount rate is 15% and inflation rate is 10%:

Year	Cash Flow	PV @ 15%
0	-100	-100
1	$35 \times 1.10 = 38.5$	$\frac{38.5}{1.15} = 33.48$
2	$50 \times 1.10^2 = 60.5$	$\frac{60.5}{1.15^2} = 45.75$
3	$30 \times 1.10^3 = 39.9$	$\frac{39.9}{1.15^3} = 26.23$
		$5.5

Year	Cash Flow	PV@4.50%
0	-100	-100
1	35	$\frac{35}{1.045} = -33.49$
2	50	$\frac{50}{1.045^2} = 45.79$
3	30	$\frac{30}{1.045^3} = 26.29$
		$= \$5.5$

Income Statement

- Revenue - Costs = EBITDA
- EBITDA - Depreciation = EBIT
- EBIT - Interest = Profit Before Tax
- Profit Before Tax - Tax = Profit After Tax

		Period							
		0	1	2	3	4	5	6	7
1	Capital investment	10,000							–1,949[a]
2	Accumulated depreciation		1,583	3,167	4,750	6,333	7,917	9,500	0
3	Year-end book value	10,000	8,417	6,833	5,250	3,667	2,083	500	0
4	Working capital		550	1,289	3,261	4,890	3,583	2,002	0
5	Total book value (3 + 4)		8,967	8,122	8,511	8,557	5,666	2,502	0
6	Sales		523	12,887	32,610	48,901	35,834	19,717	
7	Cost of goods sold[b]		837	7,729	19,552	29,345	21,492	11,830	
8	Other costs[c]	4,000	2,200	1,210	1,331	1,464	1,611	1,772	
9	Depreciation		1,583	1,583	1,583	1,583	1,583	1,583	0
10	Pretax profit (6 – 7 – 8 – 9)	–4,000	–4,097	2,365	10,144	16,509	11,148	4,532	1,449[d]
11	Tax at 35%	–1,400	–1,434	828	3,550	5,778	3,902	1,586	507
12	Profit after tax (10 – 11)	–2,600	–2,663	1,537	6,593	10,731	7,246	2,946	942

This is kinda retarded, don't be pressed about it - lines 6 to 12 are the important ones for the most part.

Cash Flow Analysis

		Period							
		0	1	2	3	4	5	6	7
1	Capital investment and disposal	–10,000	0	0	0	0	0	0	1,442[a]
2	Change in working capital		–550	–739	–1,972	–1,629	1,307	1,581	2,002
3	Sales	0	523	12,887	32,610	48,901	35,834	19,717	0
4	Cost of goods sold	0	837	7,729	19,552	29,345	21,492	11,830	0
5	Other costs	4,000	2,200	1,210	1,331	1,464	1,611	1,772	0
6	Tax on income	–1,400	–1,434	828	3,550	5,778	3,902	1,586	
7	Operating cash flow (3 – 4 – 5 – 6)	–2,600	–1,080	3,120	8,177	12,314	8,829	4,529	
8	Net cash flow (1 + 2 + 7)	–12,600	–1,630	2,381	6,205	10,685	10,136	6,110	3,444
9	Present value at 20%	–12,600	–1,358	1,654	3,591	5,153	4,074	2,046	961
10	Net present value =	+3,520	(sum of 9)						

a) Salvage value of $1,949 less tax of $507 on the difference between salvage value and ending book value.

Other Considerations

- A dollar of cash flow earlier in a project is worth more than a dollar because of the effect of discounting. With accelerated depreciation, the tax shields are larger in the earlier years.
- In real situations, it often takes several tries to purge all inconsistencies and mistakes in calculating cash flows.
    - Consider larger or smaller project? Market through wholesalers or directly to consumers?
- How would NPV be affected if inflation rages out of control? Technical problems delay start-up?
    - Sensitivity analysis may be undertaken, looking at how far the project could be knocked off course

by bad news about one of the variables.
    - Different scenarios and their effect on NPV can be constructed.
    - Break-even analysis done $\rightarrow$ how far sales could fall short of forecast before the project goes into the red.

Investment Timing

- A project with positive NPV may be more valuable if undertaken in the future.
    - Examine alternative start dates t for the investment and calculate the net future values at each of these dates. Discount net future values back to the present and select the largest value.

Equivalent Annual Cash Flows

- Suppose $400 mill investment. How much annual revenue is needed to recover cost? Find 25-year annuity with $400 mill PV.
    - PV of annuity = annuity payment x 25 year annuity factor
    - 400 = 34.3 x 11.65

$$\text{Annuity Factor} = \frac{1}{r} - \frac{1}{r(1+r)^t}$$

Equivalent Annual Costs (Long or Short-Lived Equipment)

$$\text{Equivalent Annual Cost(Annuity)} = \frac{\text{Present Value of Cash Flow}}{\text{Annuity Factor}}$$

Lecture 2 - Dealing with Risk in Capital Budgeting

Company Cost of Capital

- The expected return on a **portfolio** of all the company's existing securities.
    - Opportunity cost of capital for investment in a firm's assets.
- Opportunity cost of capital is the expected rate of return that its investors forego from alternative investment opportunities with **equivalent risk**.
- It is an appropriate discount rate for the firm's average-risk projects.

Weighted Average Cost of Capital (WACC)

- The average of the estimated required rates of return for the firm's interest-bearing debt and common equity.
- The weights used for each source of funds are equal to the proportions in which funds are raised.
    - The cost of debt financing is adjusted downward to reflect the interest tax-shield (debt is better than equity since it can be deducted from tax).
- This is about measurement not causality (a WACC of 10% doesn't cause projects to have 10% risk).

Steps in Estimating WACC

- **Step 1:** Estimate capital structure and determine the weights of each component: debt and equity.
- **Step 2:** Estimate the opportunity cost of each of the sources of financing: required return on debt and equity adjusted for the effect of taxes.
- **Step 3:** Calculate WACC:

$$\text{After-tax WACC} = (1 - T_c) r_D D/V + r_E E/V$$

Estimation Issues

- Using market weights reflect the current importance of each source of financing to the firm.
- Using market-based opportunity costs - costs should reflect current RROR rather than historical rates.
- Using forward-looking weights and opportunity costs - WACC assumes constant capital structure, use firms target weights if known.

Step 1: Evaluate Capital Structure Weights

- Represented by the fraction of the firm's invested capital contributed by each of the sources of capital.
- Market value of interest-bearing debt and common equity.

Step 2: Estimate Cost of Debt and Common Equity

- **Cost of Debt:** Yield to Maturity (YTM) on publicly-traded bonds or the risk-free rate plus a default spread given actual or projected debt rating.
- **Cost of Common Equity**: CAPM methods or DCF (DGM or Implied CoC) approach
    - Implied CoC is the internal rate of return that equates a firms market price to discounted earnings forecasts. Dividends Growth Model assumes that dividends would revert to constant EPS forever after t periods.

Cost of Debt Capital

- **Use YTM on publicly-traded bonds.**
    - Risk-free rate plus default spread given actual or projected debt rating.
- If debt is not publicly-traded, analyst should estimate the cost of debt using the YTM on a portfolio of bonds with similar credit ratings and maturity.
    - Reuters provides average spreads to Treasury data that is updated daily and cross-categorized by both default rating (Moody's, S&P, Fitch) and years to maturity.
- The cost of debt can often be approximated by taking the average cost of the firm's existing debt.

    - Although this method is the easiest to use, it confuses past costs with the future anticipated cost of debt that we actually want to measure.
- For debt with default risk, the expected cash flows must reflect the probability of default (Pb) and the recovery rate (R_c) on the debt in the event of default.
- Cost of Debt Capital is after-tax.

Cost of Common Equity

- **The rate of return investors expect from investing in the firm's stock.**
    - Common shareholders are the residual claimants of the firm's earnings, there is no promised or pre-specified return based on a financial contract.
    - Returns are based on cash distributions e.g. dividends and cash proceeds from stock sale.
- Estimation Approaches:
    - Asset Pricing Models - variants of the Capital Asset Pricing Model (CAPM)
    - Discounted Cash Flow Approach
- Three sources of error in using CAPM:
    - Model uncertainty - is the model correct?
    - Input uncertainty - are the equity risk premium and risk-free rate correct?
    - Uncertainty about current values of stock beta or factor sensitivities.

Traditional CAPM

$$r_{\text{equity}} = r_f + \beta(r_m - r_f)$$

$$\text{where } \beta = Cov(R_i, R_M)/Var(R_M)$$

- CAPM may be used to estimate a company's cost of equity based on the risk-free rate plus a premium for equity risk.
    - **Systematic or non-diversifiable risk**
        - Variability that contributes to the risk of a diversified portfolio e.g. market factors, interest rate changes, energy prices that affect almost all stocks.
        - Logic suggests stocks that are very sensitive to these sources of risk should have high required rates of return, since these stocks contribute more to the variability of diversified portfolios.
    - **Non-systematic or diversifiable risk**
        - Variability that does not contribute to the risk of a diversified portfolio e.g. random firm-specific events such as lawsuits, product defects, and various technical innovations.
        - These sources of risk should have almost no effect on required rates of return because they contribute very little to the overall variability of diversified portfolios.

Risk-Free Rate

- The risk-free rate of interest can be estimated by using a government bond rate:
    - Long-term (10 year)
    - Intermediate-term (2, 3, 5 year)
    - Short-term (1, 3, 6 month)

- **Term chosen should be consistent with the market risk premium assumption, and ideally matches the useful economic life of the asset to be valued.**
- It is the least controversial estimate we have to make for the CAPM inputs. However:
    - What is a risk-free security?
    - **What maturity should we use?**
        - Analysts typically use current short term securities to define the risk-free rate of interest when evaluating the cost of capital.
        - Choosing a maturity: As a general rule, match the maturity of the risk-free rate with the maturity of the cash flows being discounted. In practice, maturity matching is seldom done.
        - Most textbooks suggest that short-term rates be used as the risk-free rate, since they are consistent with the simplest version of the CAPM.
        - The estimated cost of equity is typically used to discount distant cash flows, it is common practice to use a long-term rate, 10 year maturity, as the risk-free rate. **This is good practice.**

Beta

- The firm's **beta represents the sensitivity of its equity returns to variations in the rates of return on the overall market portfolio**.
- Although we typically estimate a company's beta using historical returns, we should be aware that our objective is to estimate the beta coefficient that reflects the relationship between risk and return in the future.
- The beta estimate is just that - an estimate - and is subject to estimation error.
- Many analysts make a common mistake in beta estimation.
    - They fail to **match the maturity of the risk-free rate**, used to calculate beta, **with the maturity of the rate used to calculate the equity risk premium**.
    - If you use a long-term Treasury bond yield as the risk-free rate, then the excess return on the market used to calculate beta should be the excess return of the market portfolio over the long-term Treasury bond return.

How to Calculate Beta in Practice?

- Firm's historical or predicted β_e
    - Estimated by **regressing** the firm's excess stock returns on the excess returns of a market portfolio, where excess returns are defined as the returns in excess of the risk-free return.
    - Analysts typically estimate using historical returns.
    - Does this accurately reflects the relationship between risk and return in the future?
- Beta estimate based on betas of **comparable firms**
    - Publicly-traded peers selected by business mix and relative risk.
    - Involves adjustments for differences in capital structure.
    - Involves "**unlevering**" the betas for each of the sample firms to remove the influence of capital structure:

$$\beta_a = \beta_D(D/V) + \beta_E(E/V)$$

    - The average of the unlevered betas is relevered to reflect the capital structure of the target firm.

$$\beta_E = \beta_A + (\beta_A - \beta_D)D/E$$

- Preferred estimation method for privately-held firms.

Time Frame for Measurement of Beta

- Most publicly available betas are estimated with short-term risk-free rates or simply by regressing stock returns on market returns.
- **If a long-term maturity is used for the risk-free rate, to match the maturity of the cash flows, it is also advisable that the beta estimate should reflect the longer-maturity risk-free rate.**
- A longer estimation time frame (5 years) smooths out irregularities in the market, which may be present over shorter periods of time.
- A shorter period (2 years) may be more appropriate for companies in dynamic, high growth industries or for recently restructured companies.
- Typically at least 3 years is used to capture statistically significant return experience.

Issues with Company Cost of Capital

- Capital Structure:
  - Use market value weights for capital structure. If a change is expected, target weights should replace current weights.
- Cost of Capital Best Practices:
  - Yield on a long-term bond in the estimation of the market risk premium, as well as in calculating the excess market returns that are used in the estimation of beta.
  - Use multiple methods to compute cost of debt and cost of equity.
  - The focus of our analysis should be forward-looking; but should not ignore historical data.

Required Rates of Returns for PROJECTS

Different from WACC

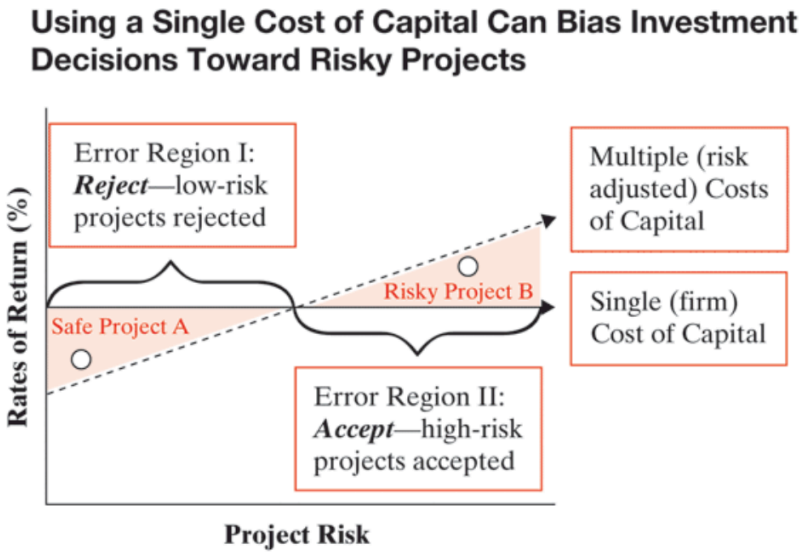
- **Discount rates used to evaluate individual investment projects are not necessarily the same as WACC.**
  - Firms are faced with a variety of investment opportunities with different risks and financing alternatives.
- Technical and political issues arise within a firm's organisation that complicates the process of estimating project rates of return.
- More than 50% of the surveyed firms used a single, company wide discount rate to evaluate all investment proposals.
  - Firms can realise substantial gains through the use of project-specific discount rates.

Reflecting Risk

- **Investment projects that are less risky and add more to the firm's ability to raise debt capital should require a lower discount rate.**
  - Discount rates should reflect the opportunity cost of capital/risk of the investment.
- Investment project expected returns should be judged in comparison to returns that could be generated from investments in publicly traded stocks and bonds with equivalent risk.

- Less risky investments (cash flows resembling the cash flows of a portfolio of bonds) will have an opportunity cost of capital that is lower than more risky investments (cash flows resembling the cash flows of a portfolio of stocks).
- **Multiple discount rates should be used when risk attributes of projects varies widely.**
    - Firms operating in different lines of business
    - Firms operating in different countries
- Incentive problems that arise with managerial discretion can be mitigated.
    - Systematic and verifiable cost of capital estimation.
    - Discount rates tied to outside market forces

Issues with Single Discount Rate



- When a single discount rate (firm WACC) is used, the firm will tend to take on investment projects that are relatively risky (Project B), which appear to be attractive because they generate a return that exceeds the firm's WACC.
- **The firm will tend to pass up investment projects that are relatively safe (Project A), but which generate returns that are less than the firm's WACC.**
- This bias in favour of high-risk projects will make the firm riskier over time.

Divisional WACC

- Isolates costs of capital for **each business unit or divisions** (defined either by geographical regions or industry lines of business).
- Only one cost of capital estimate per division as opposed to per project.
- Advantages:
    - Discount rates reflect difference in the systematic risk within each division.
    - Minimises time and effort.
    - Limits managerial latitude and influence costs.
- Implementation using industry-based comparison has a number of potential shortcomings:
    - Poor sample of comparable firms in a given industry (too small or too large causing subjectivity in selection).
    - Capital structure - differences in use of leverage.

- Differences in project risks for investments within a division.
- Good 'comps' for a particular division may be difficult to find.

What Determines Asset Betas?

- Asset betas are unlevered betas. Equity betas are levered betas.

Cyclicality

- The strength of the relationship between the firm's earnings and the aggregate earnings on all real assets.
- Measure this either by the **earnings beta** or by the cash-flow beta.
  - These are just like a equity beta except that changes in earnings or cash flow are used in place of rates of return on securities.
- Firms with high earnings or cash-flow betas should also have high asset betas
- **Cyclical firms, firms whose revenues and earnings are strongly dependent on the state of the business cycle, tend to be high-beta firms.**
- You should demand a higher rate of return from investments whose performance is strongly tied to the performance of the economy

Operating Leverage

- **A production facility with high fixed costs, relative to variable costs, is said to have high operating leverage.**
- High operating leverage means a high asset beta.
- Cash flows generated by an asset can be broken down into revenue, fixed costs, and variable costs:
  - Cash flow = revenue - fixed cost - variable cost
- Break down the asset's present value in the same way:
  - PV(asset) = PV(revenue) - PV(fixed cost) - PV(variable cost)

$$\beta_{\text{revenue}} = \beta_{\text{fixed cost}} \frac{\text{PV(fixed cost)}}{\text{PV(revenue)}} + \\ + \beta_{\text{variable cost}} \frac{\text{PV(variable cost)}}{\text{PV(revenue)}} + \beta_{\text{asset}} \frac{\text{PV(asset)}}{\text{PV(revenue)}}$$

- The fixed-cost beta should be about zero; whoever receives the fixed costs receives a fixed stream of cash flows.
  - The betas of the revenues and variable costs should be approximately the same, because they respond to the same underlying variable, the rate of output.

$$\beta_{asset} = \beta_{revenue} \frac{PV(revenue) - PV(variable\ cost)}{PV(asset)}$$

$$= \beta_{revenue} \left[1 + \frac{PV(fixed\ cost)}{PV(asset)} \right]$$

Possible Bad Outcomes

- Project cash flows are supposed to be unbiased forecasts that give due weight to all possible outcomes, favourable and unfavourable.
- Managers making unbiased forecasts are correct on average - high and low forecast errors average out over many projects.

Example 1

Project Z will produce just one cash flow, forecast to be $1 million at year 1.

Possible Cash Flow	Probability	Probability-Weighted Cash Flow	Unbiased Forecast
1.2	0.25	0.3	1.0, or $1 million
1.0	0.50	0.5	
0.8	0.25	0.2	

It is regarded as average risk, suitable for discounting at a 10% company cost of capital:

$$PV = \frac{C_1}{1+r} = \frac{1{,}000{,}000}{1.1} = \$909{,}100$$

Example 2

The company's engineers are behind schedule in developing the technology required for the project. They are confident it will work, but they admit to a small chance that it will not.

You see the most likely outcome as $1 million, but you also see some chance that project Z will generate zero cash flow next year.

Possible Cash Flow	Probability	Probability-Weighted Cash Flow	Unbiased Forecast
1.2	0.225	0.27	0.90, or $900,000
1.0	0.45	0.45	
0.8	0.225	0.18	
0	0.10	0.0	

The value of the project taking account of possible failure is:

$$\text{PV} = \frac{900{,}000}{1.1} = \$818{,}000$$

Not including the possible bad outcome results in upward bias in the estimated value of the project (PV=$909,100).

Certainty Equivalents

- There are two ways to value a risky cash flow:
  - Method 1: Discount the risky cash flow at a risk-adjusted discount rate r that is greater than r_f, since it adjusts for both time and risk.
  - **Method 2:** Find the certainty-equivalent cash flow and discount at the risk-free interest rate r_f.
    - What is the smallest certain payoff for which I would exchange the risky cash flow?

The generic certainty equivalent formula is:

$$PV = \frac{C_t}{(1+r)^t} = \frac{a_t C_t}{(1+r_f)^t} = \frac{CEQ_t}{(1+r_f)^t}$$

Where a is given by: $$a = \frac{(1+r_f)^t}{(1+r)^t}$$

Use of a constant risk-adjusted discount rate for a stream of cash flows assumes that risk accumulates at a constant rate as you look farther out into the future.

Lecture 3 - Project Analysis using Tools for Uncertainty

- Look at Otobai.xslx while going over lecture slides.

Project Analysis

- **Phase I**
  - Analyst tries to envision the possible outcomes from an investment.
  - Analyst prepares **estimates and forecast**.
    - Forms the basis for estimating an expected value for the investment along with NPV, iRR, and other measures of investment worth.
- **Phase II**
  - Analyst details **underlying sources of risk**.
    - Identify value drivers and uncertainty
  - Analyst seeks ways to mitigate risks and monitors throughout the life of the project.
- Although it may give an impression of high level scientific precision, the underlying basis for using investment analysis tools is inherently subject on the individual analysts.

Sensitivity Analysis

- **Sensitivity analysis investigates an investment's value under different situations** e.g. NPV after estimate of costs as percentage of sales increases (from 50 to 55%).
  - The standard approach to sensitivity analysis evaluates the project using **optimistic and pessimistic** estimates for the input assumptions.
- Input are changed one at a time, holding all other inputs constant.

Determining Value Drivers

- The input variables that have the greatest impact on project value are known as the **projects value drivers** (or risk factors).
- To determine which input has the greatest impact vary each by 1% (holding the other inputs constant) and determine the percentage change in value.

Limits to Sensitivity Analysis

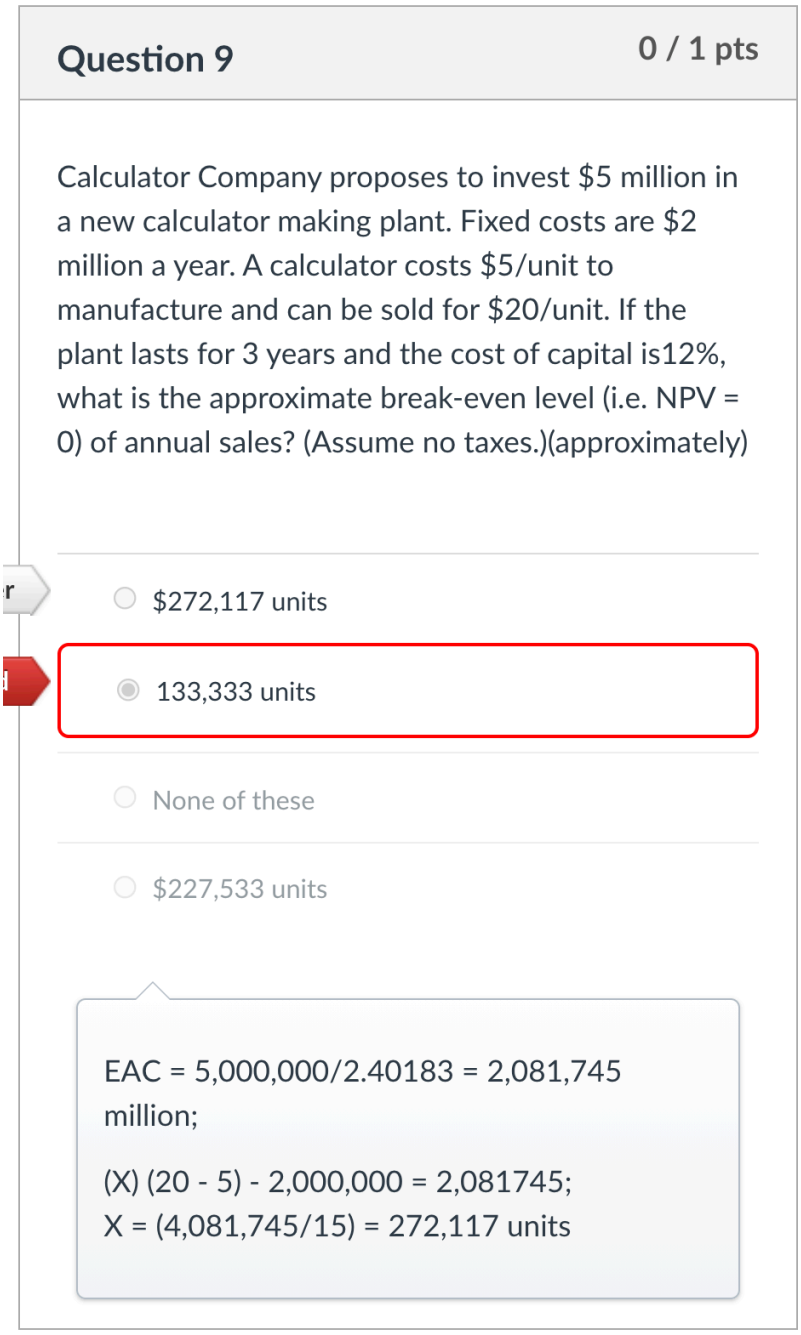
- What exactly does optimistic or pessimistic mean?
  - The marketing department may be interpreting the terms in a different way from the production department.
- The underlying variables are likely to be interrelated.
  - If inflation pushes prices to the upper end of your range, it is quite probable that costs will also be inflated.
- Sensitivity analysis boils down to expressing cash flows in terms of key project variables and then calculating the consequences of misestimating the variables.
- It forces the manager to identify the underlying variables, indicates where additional information would be most useful, and helps to expose inappropriate forecasts.

Scenario Analysis

- **Scenario analysis** is a technique that helps analysts explore the sensitivity of an investment's value under different future situations or scenarios.
    - We use the term scenario to refer to different sets of assumptions about the realized values of each of the value drivers.
- We could analyse scenarios involving **multiple sets of changes in assumptions and forecasts**.
    - We might evaluate the project first using the most optimistic estimates for the value drivers and then the most pessimistic estimates.
- Although scenario analysis is very useful, there is no systematic way to define the scenarios. The number of possible scenarios is limited only by the imagination of the analyst performing the analysis.
- Scenario analysis enables key executives to prepare a carefully crafted story about the future.
    - The process of writing such a story provides an opportunity for executives to learn about what can happen to an investment and, in so doing, to prepare for the future accordingly.
    - This idea does not make managers better forecasters; instead, the value of the process is that managers will make themselves aware of potential problems and opportunities so that they can be prepared to take advantage of them when and if they arise.
- The very act of identifying conditions under which the plug should be pulled on a project can make managers aware of when and why it should be done.

Break Even Analysis

- Asks how bad things can get before the project NPV turns negative.
- Can be done in Excel.



Simulation

- Simulation is a tool for considering larger numbers of combinations. It enables you to generate a distribution of project outcomes.

Step 1: Modelling the Project

- Sensitivity analysis of the scooter project was based on the following model of each year's cash flow:
  - Cash Flow = operating cash flow - investment in working capital
  - Operating Cash flow = (revenues - costs - depreciation) x (1 - tax rate) + depreciation
  - Revenues = unit sales x unit price
  - Costs = (revenue x variable unit as a proportion of revenue) + fixed cost

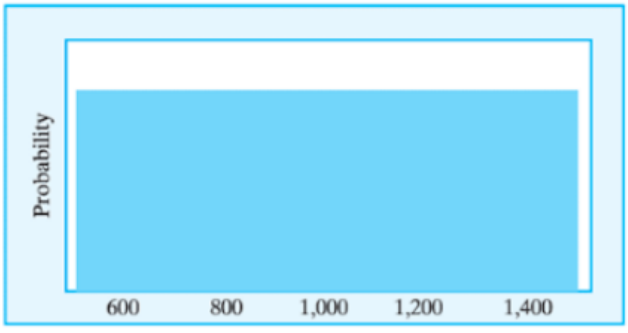
Step 2: Specifying Probabilities

Choosing a Probability Distribution

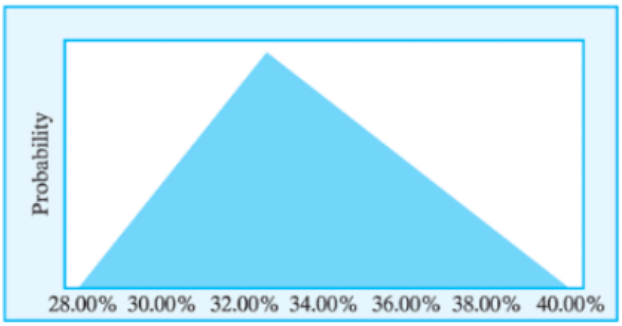
- When building a simulation model, it is necessary to identify not only the **key value drivers** but also an **appropriate probability distribution** to describe the randomness and estimate the parameters of that distribution
    - If you have relevant data, then by all means use it.
    - Does the variable you are modelling assume only discrete values? For example, if the variable you are estimating can be only zero or one (or yes or no), then a discrete distribution will work for you.
- Select distributions that fit the wisdom of the experts from whom you will elicit parameter estimates.
    - For example, if your experts can tell you only the maximum and minimum values of a variable you are estimating, then the uniform distribution may be a reasonable.. If your expert is willing to specify a minimum and maximum as well as a most likely value, then the triangular distribution is a good candidate for you.
- Consider theoretical reasons for selecting a particular distribution.
- Keep it simple is always appropriate. You must elicit information from experts. Because this may require having discussions with individuals not well versed in the language of probability and probability distributions, it is best to err on the side of simplicity rather than on the side of precision and sophistication.

Popular Probability Distributions: The Uniform and Triangular Distributions

- Among the set of distributions that can be used to model the uncertainty inherent in an investment, the uniform and triangular distributions are two of the most popular.
- An important reason for this is that the variables needed to define the shape of both distributions (known as their parameters) are **very intuitive**.
- Although they are simple, they are **very flexible** and can be used to capture the essence of the randomness of lots of random variables.
- This is particularly true of the triangular distribution: Its form can be shaped and stretched to capture both symmetric and skewed distributions.

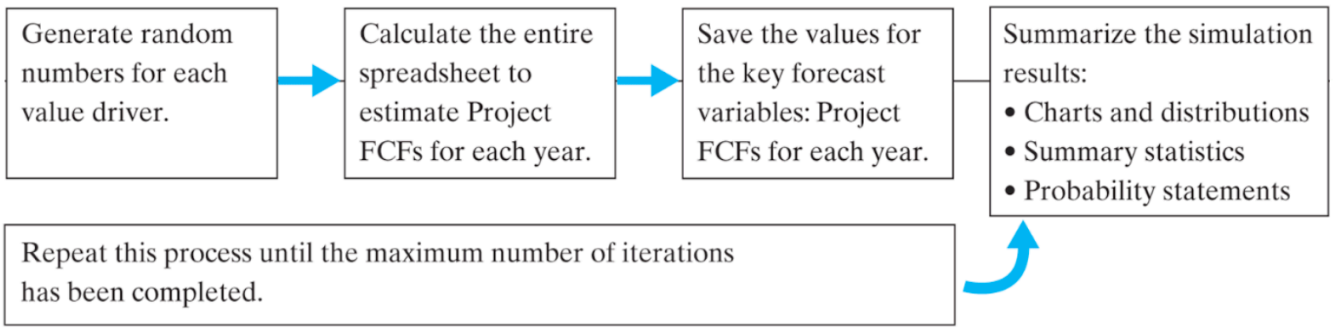


- In the uniform distribution, all values between the minimum and maximum are equally likely to occur. The only details we need to know in order to define a uniform distribution completely are the minimum and maximum values that the random variable can take on.



- The triangular distribution can be described by the minimum, maximum, and most likely values. The triangular distribution is very flexible and can be skewed in either direction and can also be symmetrical.

Step 3: Simulate Cash Flows and Calculate PV



- Can be found in Excel sheet and Lecture slides.

Decision Trees

- The decision tree contains a **number of nodes identified by vertical lines, circles, and boxes**.
  - Vertical lines denote terminal nodes that signal the ends of decision processes.
  - Circles signify event nodes that represent points where nature intervenes and something happens that is subject to chance.
  - Squares depicts a decision node that represents a point where the decision maker determines what happens.
- Adding estimates of:
  - The probabilities associated with chance events
  - The dollar payoff for each alternative
- A decision tree can be used to compute the expected value of the payoff from a decision.

Lecture 4 - Sources of Value

How Firms Organise the Investment Process

- **The Capital Budget**
  - Needs to reflect the corporation's strategic plan
  - Identify company competitive advantage
  - Identify businesses to be sold or allowed to run down
  - Should reflect both bottom-up and top-down views
- **Project Authorizations**
  - Planning for ensuing year
  - Needs to be supported by detailed analysis, cash-flow forecasts, and present value calculations
- **Postaudits**
  - Conduct postaudit shortly after project begins operation
  - Identify problems that need fixing
  - Check accuracy of forecasts
  - Suggest questions that should have been asked

Market Values

- Smart investment decisions make more money than smart financing decisions $\rightarrow$ they have positive NPVs.
- However, projects may appear to have positive NPVs because of **forecasting error** e.g. some acquisitions result from errors in a DCF analysis.
  - **Positive NPVs stem from a comparative advantage.**
- Strategic decision-making identifies this comparative advantage; it does not identify growth areas.
- DON'T make investment decisions on the basis of errors in your DCF analysis.
  - Steming from: management overestimating NPV for personal gain, growth rate overestimation, human error.
- Start with the market price of the asset and ask whether it is **worth more to you than to others**.

Do Projects Have Positive NPVs?

- **Economic rents**: profits that more than cover the cost of capital. $NPV = PV(\text{rents})$
- Economic rents come only when you have a better product, lower costs, or some other competitive edge.
  - Sooner or later competition is likely to eliminate economic rents.

Structure-Conduct-Performance Framework

- The framework argues that the **structure of the industry influences the conduct of the firms within that industry, which in determines industry performance**.
- In its simplest form, the structure-conduct-performance model says that a highly concentrated market structure, dominated by a few large firms, will give rise to little rivalry and excessive prices and profits.
- On the other hand, a structure consisting of many small firms will produce a high degree of rivalry and low prices and profits.

Perfect Competition

- The firm is seen as a production function that transforms inputs into outputs, in accordance to the goal of maximizing profits.
- **The assumptions of the model are:**
  - There are many firms, each of which is small, all selling homogeneous products.
  - Firms have perfect information, and
  - There are no entry barriers or other market imperfections.
- Firms attempt to maximize profits, and do so by **setting marginal revenue** (the product price, taken as given where market supply equates with market demand) **equal to marginal costs**.
- If prices initially exceed marginal cost, so that firms make a positive economic profit, entry occurs, which then drives down prices.
- When the market is in long-run equilibrium, prices equal marginal costs and also average costs so that economic profits are zero.
- This implies all investments have **NPV = 0**.

Monopolistic Competition

- A variant on the model of perfect competition that **allows for differentiation by firms.**
- In the model of monopolistic competition, firms still maximize profits by **setting marginal revenue equal to marginal cost**.
- However, successful product differentiation gives rise to excess profits, which persist at long-run equilibrium.
- Patents, trademarks, customer service, reputation, and the like can all be the source of competitive advantage; these sources of differentiation are considered to be resources in the resource-based view of the firm.

Monopoly

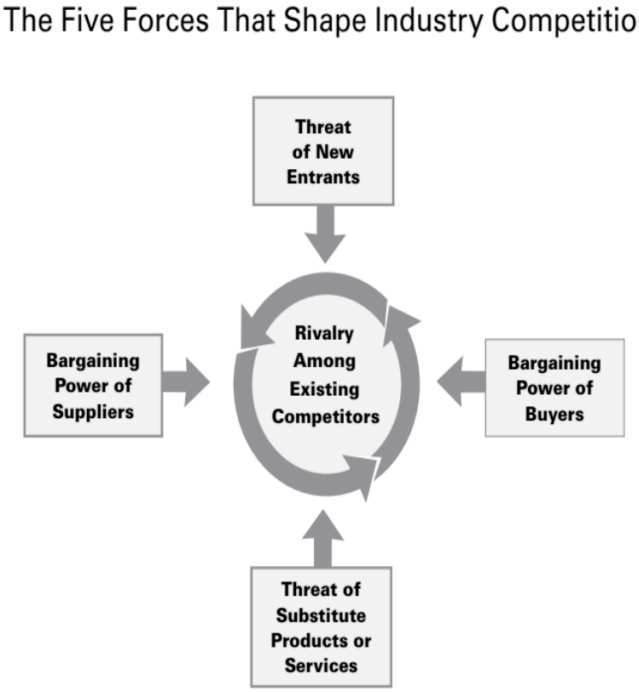
- There is one firm in the market.
  - This firm is assumed to be knowledgeable about the market demand curve, it has information about what price each potential customer is willing to pay for its product.
- The monopolist then **sets price to maximize its profits**.
- In the basic model of monopoly, strong barriers to entry exist, so that the monopolist's excess profits persist in the long run.
- **All investments are NPV positive.**

Porter's Approach

- Porter pioneered the application of Economic concepts to strategy formulation.
- He viewed the structure-conduct-performance approach as giving managers a systematic model for assessing competition and for developing profit-maximizing strategies.
- **The approach has three parts:**
  - Select attractive industry
  - Develop competitive advantage through cost leadership, product differentiation, or focus

- Develop attractive value chains

Attractive Industry



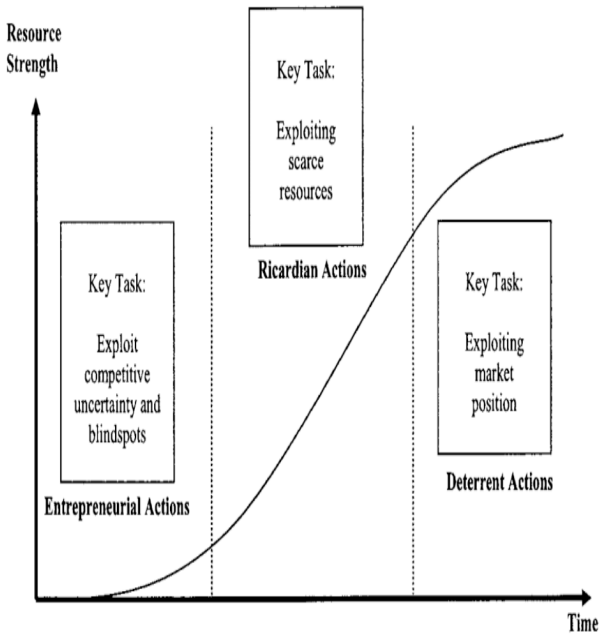
- Entry barriers high
- Suppliers and buyers have weak bargaining power
- Few substitute products/services available
- Stable rivalry among competitors

Steps in Industry Analysis

- **Define the relevant industry:**
  - What products are in it? Which ones are part of another distinct industry?
  - What is the geographic scope of competition?
  - Identify the participants and segment them into groups, if appropriate:
- **Who are**
  - the buyers and buyer groups?
  - the suppliers and supplier groups?
  - the competitors?
  - the substitutes?
  - the potential entrants?
- Assess the **underlying drivers of each competitive force** to determine which forces are strong and which are weak and why.
- Determine **overall industry structure**, and test the analysis for consistency:
  - Why is the level of profitability what it is?
  - Which are the controlling forces for profitability?
  - Is the industry analysis consistent with actual long-run profitability?
  - Are more-profitable players better positioned in relation to the five forces?
- Analyse **recent and likely future changes** in each force, both positive and negative.

- Identify aspects of industry structure that might be influenced by competitors, by new entrants, or by your company.

A Dynamic View



- **The First Stage:**
  - Small firm, new venture, or firm in need of a turnaround.
  - Has limited resources and a poor competitive position in relation to rival firms.
  - This firm must rely on entrepreneurial discovery or the managers' capability to **exploit uncertainty and blind spots** by taking entrepreneurial actions.
- **The Second Stage:**
  - As the firm evolves to a high-growth stage, attention shifts from entrepreneurial discovery and action to the exploitation of specific resources by **exploiting scarce resource ownership.**
- **The Third Stage:**
  - A shift in the firm's orientation away from exploitation of resource advantages to **defense of market position with deterrent actions**.
  - Deterrent actions in defense of position include limiting output, acting with predatory pricing, buying out competitors, and securing sources of material.

Lecture 4 also contains examples on :

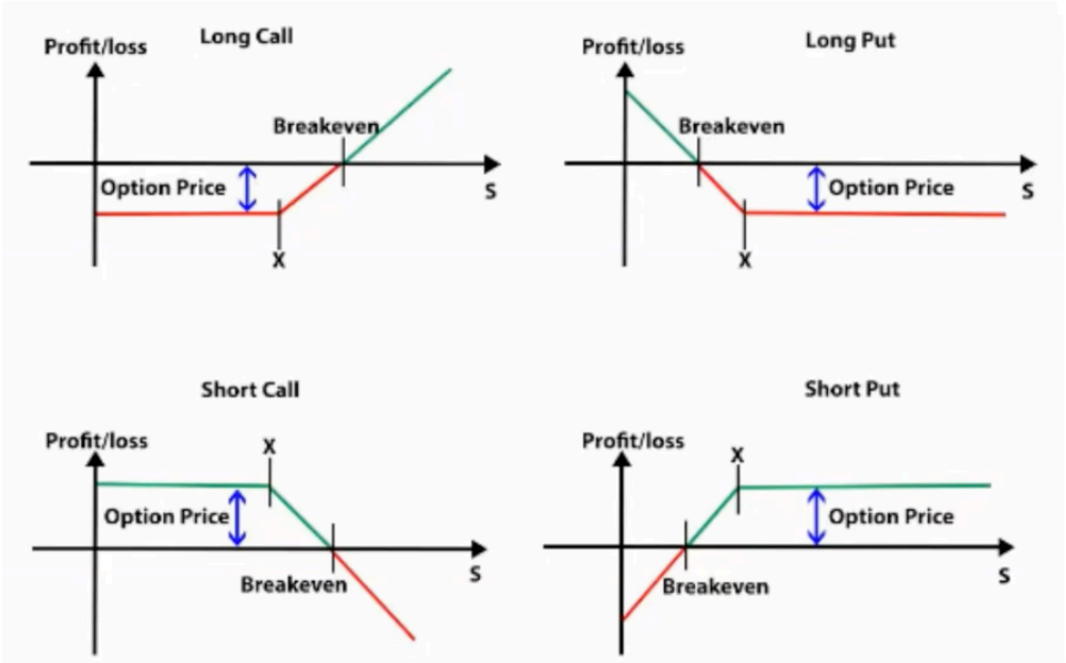
- Economic Rents and Competitive Advantage (i.e. recalculating NPV with introduction of competition),

Lecture 5 - Options and Corporate Finance

- Investments in real assets create choices for a firm. We are interested in the value of a **choice**, so we look at financial options.

Financial Option

- A contract that gives its owner the right (but not the obligation) to purchase or sell an asset at a fixed price as some future date.
    - This is a choice.
- **Call Option:** a financial option that gives its owner the right to buy an asset.
- **Put Option:** a financial option that gives its owner the right to sell an asset.
- **Option Writer:** the seller of an option contract
- **Exercising an Option:** when a holder of an option enforces the agreement and buys or sells a share of stock at the agreed-upon price
- **Strike Price (Exercise Price):** the price at which an option holder buys or sells a share of stock when the option is exercised
- **Expiration Date:** the last date on which an option holder has the right to exercise the option
- **The option buyer (holder):** holds the right to exercise the option and has a long position in the contract
- **The option seller (writer):** sells (or writes) the option and has a short position in the contract
    - Because the long side has the option to exercise, the short side has an obligation to fulfil the contract if it is exercised. The buyer pays the writer a premium.
- **American Option:** options that allow their holders to exercise the option on any date up to, and including, the expiration date
    - Note that name has nothing to do with location.
- **European Option:** options that allow their holders to exercise the option only on the expiration date



Option Payoffs at Expiration

Long Position in an Option Contract

Put Option (Right to Sell)

- The value of a put option at expiration is:

$$P = \max(K - S, 0)$$

- where S is the stock price at expiration, K is the exercise price, P is value of the put option.
    - As an owner of a **put**, you are able to **buy at current prices** and **sell at the strike price**, pocketing the difference (i.e. you want the stock to go down).

You own a put with an exercise price of $20 that expires today. Plot the value of this option as a function of the stock price.

- Let S be the stock price and P be the value of the put option. The value of the option is

$$P = max(20 - S,\ 0)$$

- Plotting this function gives

Call Option (Right to Buy)

- As an owner of a **call**, you are able to **buy at strike price** and **sell at current prices**, pocketing the difference (i.e. you want the stock to go up).

$$C = \max(S - K, 0)$$

Short Position in an Option Contract

Put Option

- As a seller of a put, you are obliged to **buy back the stock** at the strike price.

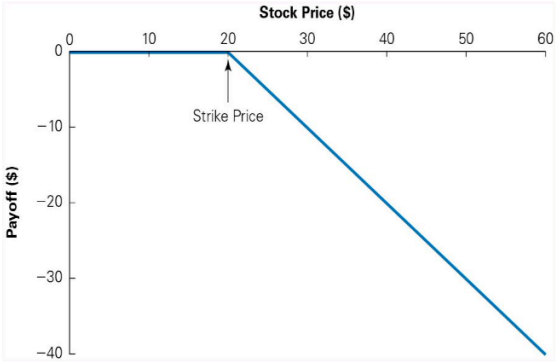
You are short in a put option with an exercise price of $20 that expires today.

If S is the stock price, your cash flows will be

$$-max(20-S,\ 0)$$

Call Option

- As a seller of a call, you are obliged to **sell the stock** at the strike price.



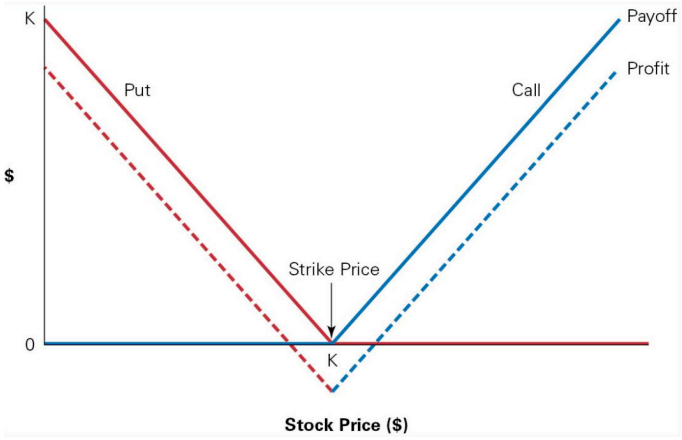
Profit at Expiration

- Although pay outs on a long position in an option contract are never negative, the profit from purchasing an option and holding it to expiration could be negative because the payout at expiration might be less than the initial cost of the option.
- The maximum loss on a purchased call option is 100% (when the option expires worthless).
    - Out-of-the money call options are more likely to expire worthless, but if the stock goes up sufficiently, it will also have a much higher return than an in-the-money call option.
- Call options have more extreme returns than the stock itself. This is because returns are amplified since cost of option may be less than stock price.

Combining Options

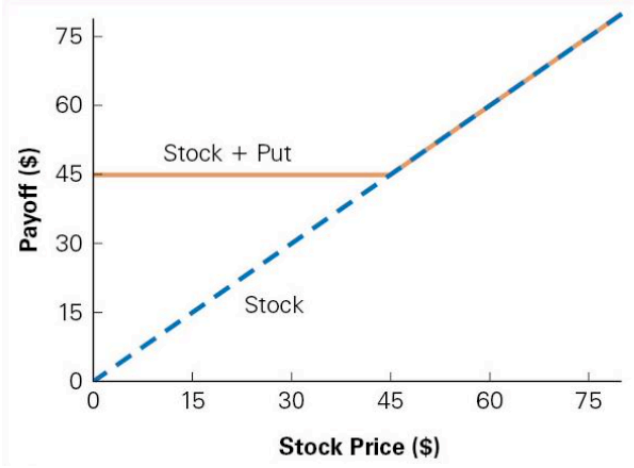
Straddle

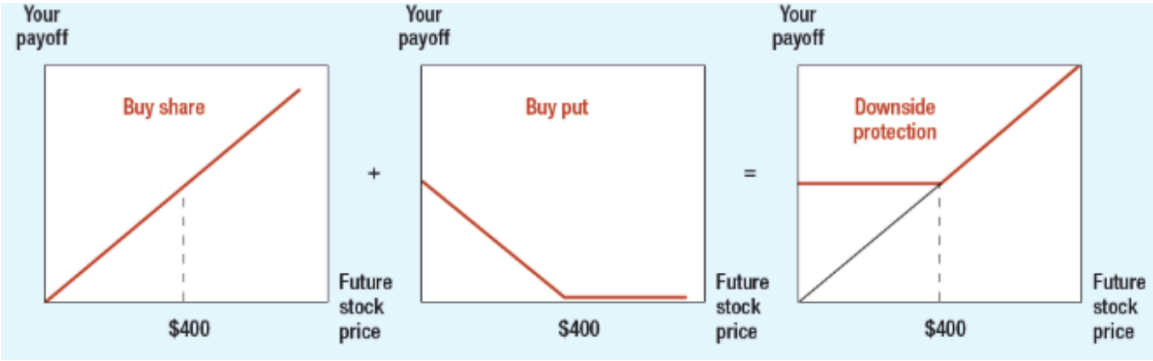
- A portfolio that is long a call option and a put option on the same stock with the same exercise date and strike price.
- This strategy may be used if investors expect the stock to be very volatile and move up or down a large amount, without necessarily a view on which direction it will move.



Protective Put

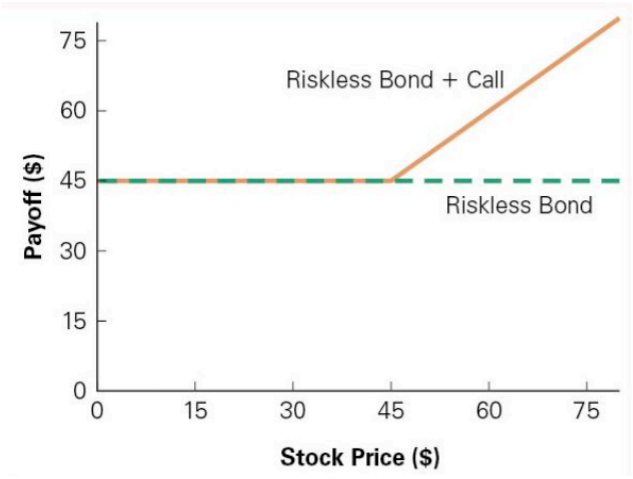
- A long position in a put held on a stock you already own.

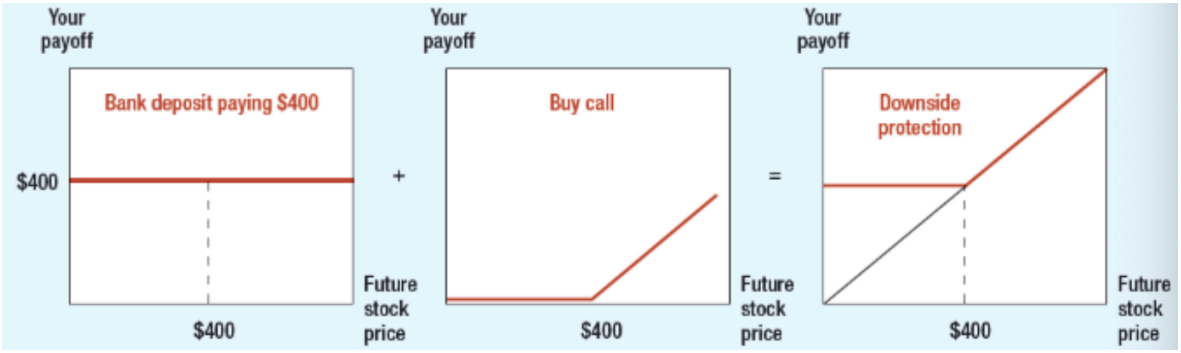




Portfolio Insurance

- A protective put written on a portfolio rather than a single stock.
    - Can be achieved by purchasing a bond and a call option.





Put Call Parity

- Consider the two different ways to construct portfolio insurance. Since both positions provide exactly the same payoff, the **Law of One Price** requires that they must have the same price.
    - Purchase the stock and a put
    - Purchase a bond and a call
- Since they have the same price, where K is the strike price of the option (the price you want to ensure that the stock will not drop below), C is the call price, P is the put price, and S is the stock price.

$$S + P = PV(K) + C$$

- Rearranging terms gives an expression for the **price of a European call option for a non-dividend paying stock**:
    - This relationship between the value of the stock, the bond, and call and put options is known as put-call parity.

$$C = S + P - PV(K)$$
$$P = C - S + PV(K)$$

Factors Affecting Option Prices

Strike Price and Stock Price

- The value of a **call** option increases (decreases) as the **strike** price decreases (increases), all other things held constant.
- The value of a **put** option increases (decreases) as the **strike** price increases (decreases), all other things held constant.
- The value of a **call** option increases (decreases) as the **stock** price increases (decreases), all other

things held constant.
- The value of a **put** option increases (decreases) as the **stock** price decreases (increases), all other things held constant.

Option Prices and the Exercise Date

- For all options, the **longer the time to exercise date, the more valuable the option**.
- An American option with a later exercise date cannot be worth less than an otherwise identical American option with an earlier exercise date, since both can be exercised immediately anyways.
- A European option with a later exercise date can be worth less than an otherwise identical European option with an earlier exercise date e.g if stock price goes to zero due to bankruptcy.

Option Prices and the Rate of Interest

- Investors who acquire stock by way of a **call option are buying on credit**.
- They pay the purchase price of the option today, they do not buy the stock until they exercise the option.
- The delay in payment is valuable if interest rates are high: high opportunity cost $\rightarrow$low $PV(K) \rightarrow$ high C.

Option Prices and Volatility

- The **value of an option generally increases with the volatility of the stock**.
- Option holders gain from volatility because the payoffs are not symmetric.
    - If the stock price falls below the exercise price a call option will be worthless, regardless of whether the price is a few cents or many dollars below the exercise price.
    - For every dollar that the stock price rises above the exercise price the call will be worth an extra dollar.
    - Option holders gain from the increased volatility on the upside, but do not lose on the downside.

1. If There Is an *Increase* in:	The Change in the Call Option Price Is:
Stock price (P)	Positive
Exercise price (EX)	Negative
Interest rate (r_f)	Positive*
Time to expiration (t)	Positive
Volatility of stock price (σ)	Positive*
2. Other Properties of Call Options:	
a. *Upper bound.* The option price is always less than the stock price.	
b. *Lower bound.* The call price never falls below the payoff to immediate exercise ($P - EX$ or zero, whichever is larger).	
c. If the stock is worthless, the call is worthless.	
d. As the stock price becomes very large, the call price approaches the stock price less the present value of the exercise price.	

Option Value

- Equity can be thought of as a call option on the company's assets with a strike price equal to the face value of the debt.
- Debt, from the lender's point of view, can be viewed as a short put with a risk free bond.

Replicating Portfolio

- A portfolio of assets that has the same payoff as a call option.
- Combining a long position in equity and a loan into a portfolio will provide the same payoff as a call.
- The value of two portfolios will be equal by the law of one price.

Simple One Period Valuation

Assumptions

- The option expires in one period.
- The price of the stock will end up at one of two possible values.
- The value of the option can be computed at each of these values.
- Form a portfolio long delta shares and a loan (short debt).

Model

- The number of shares needed to replicate one call is called the hedge ratio or option delta.

$$\text{Option Delta} = \frac{\text{spread of possible option prices}}{\text{spread of possible share prices}}$$

- The amount to borrow from the bank is the present value of the difference between the payoff from the option and the payoff from delta shares in one of the states.

	Stock Price = $424	Stock Price = $662.50
0.556 shares	$235.56	$368.06
Repayment of loan + interest	–235.56	–235.56
Total payoff	$ 0	$132.50

Notice that the payoffs from the levered investment in the stock are identical to the payoffs from the call option. Therefore, the law of one price tells us that both investments must have the same value:

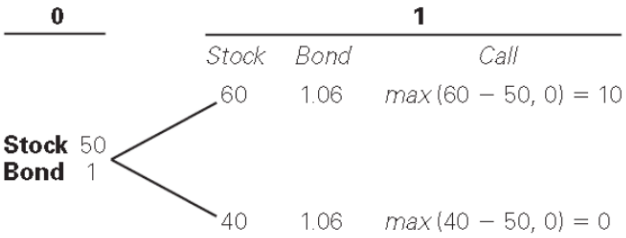
$$\text{Value of call} = \text{value of .556 shares} - \text{value of bank loan}$$

$$= .556 \times \$530 - 235.56/1.01 = \$61.22$$

- **FOR CALLS, WE BORROW FROM THE BANK. FOR PUTS, WE LOAN THE BANK.**

Example

- A European call option expires in one period and has an exercise price of $50.
  - The stock price today is equal to $50.
- In one period, the stock price will either rise by $10 or fall by $10. The one-period risk-free rate is 6%.



- Let Δ be the number of shares of stock purchased and B be the initial investment in bonds.
- Spread of option prices = 10 - 0 = 10.
- Spread of stock prices = 60 - 40 = 20
- Δ = 10/20 = 0.5

$$\text{Amount Borrowed} = \text{PV}(\Delta\text{*share price - option value})$$
$$= PV(0.5 * 40 - 0) = 20/1.06 = 18.8679$$

- By the Law of One Price, the price of the call option today must equal the current market value of the replicating portfolio.
- The value of the portfolio today is the value of 0.5 shares at the current price of $50, less the amount borrowed.

$$50\Delta - B = 50(0.5) - 18.87 = 6.13$$

Risk-Neutral Valuation Notice why the Google call option should sell for $61.22. If the option price is higher than $61.22, you could make a certain profit by buying .556 shares of stock, selling a call option, and borrowing the present value of $235.56. Similarly, if the option price is less than $61.22, you could make an equally certain profit by selling .556 shares, buying a call, and lending the balance. In either case there would be an arbitrage opportunity.[3]

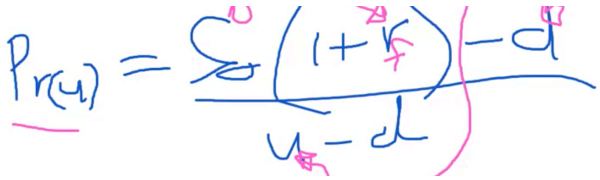
Risk-Neutral Valuation

- Pretend that investors do not care about risk (if it's not correctly priced, anyone regardless of risk appetite would rush to make use of arbitrage opportunity), so that the expected return on the stock is equal to the interest rate. Calculate the **expected future value** of the option in this hypothetical risk-neutral world and discount it at the **risk-free interest rate**.

Suppose ABCD's stock price is currently $50. In the next six months it will either fall to $40 or rise to $80. What is the current value of a six-month call option with an exercise price of $50? The six-month risk-free interest rate is 2% (periodic rate).

- (●) $8.25
- ( ) $2.40
- ( ) $15.00
- ( ) $8.09

Replicating portfolio method: Call option payoff = 80 - 50 = 30 and zero;
(80)(A) + (1.02)(B) = 30, (40)(A) + 1.02(B) = 0; A = 0.75 (option delta)&
B = -29.41; call option price (current) = 0.75(50) - 29.41 = $8.09
Risk-neutral valuation: 50 = [x (80) + (1 - x)40]/1.02); x = 0.275; (1 - x) = 0.725;
Call option value = [(0.275)(30) + (0.725)(0)]/(1.02) = $8.09



- Probability of up is the stock price times (1 + risk free rate) - down/up - down.

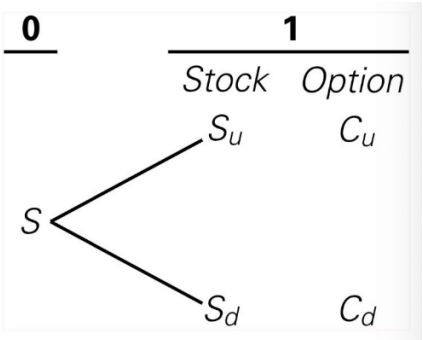
Binomial Pricing

Assumptions

- S is the current stock price, and S will either go up to S_u or go down to S_d next period.
- The risk-free interest rate is r_f.
- C_u is the value of the call option if the stock goes up, and C_d is the value of the call option if the stock goes down.

Model

- The binomial tree would look like the figure:



- The payoffs of the replicating portfolios could be written as follows:

$$S_u\Delta + (1+r_f)B = C_u \text{ and } S_d\Delta + (1+r_f)B = C_d$$

- Option price in the Binomial Model is:

$$C = S\Delta + B$$

- where:

$$\Delta = \frac{C_u - C_d}{S_u - S_d} \text{ and } B = \frac{C_d - S_d\Delta}{1+r_f}$$

- **ALTERNATIVELY, USE EXPECTED VALUES METHOD WITH PAYOFF**

Multiperiod Pricing

- The binomial model can be extended to multiple time steps.
- Prices move up or down at each time step.
- To calculate the value of an option in a multi period binomial tree, start at the end of the tree and work backward.
- Although binary up or down movements are not the way stock prices behave on an annual or even daily basis, by decreasing the length of each period, and increasing the number of periods in the stock price tree, a realistic model for the stock price can be constructed.

Black-Scholes Option Pricing Model

- A technique for pricing European-style options when the stock can be traded continuously.
- It can be derived from the Binomial Option Pricing Model by allowing the length of each period to shrink to zero and letting the number of periods grow infinitely large.
    - where S is the current price of the stock, K is the exercise price, and $N(d)$ is the cumulative normal distribution.

$$C = S \times N(d_1) - PV(K) \times N(d_2)$$

- WHERE:

$$d_1 = \frac{\ln\left[\frac{S}{PV(K)}\right]}{\sigma\sqrt{T}} + \frac{\sigma\sqrt{T}}{2} \quad \textit{and} \quad d_2 = d_1 - \sigma\sqrt{T}$$

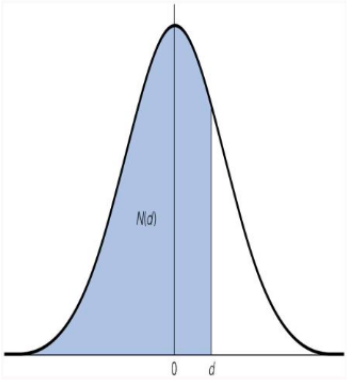
- σ is the annual volaility, and T is the number of years left to expiration.

Five Inputs for Formula

- Stock price
- Strike Price
- Exercise Date
- Risk-free Rate
- Volatility of Stock

Cumulative Normal Distribution

- The probability that an outcome from a standard normal distribution will be below a certain value.



Dividend Paying Stock

- The holder of a European call option does not receive the benefit of any dividends that will be paid prior to the expiration date of the option.
- The stock price tends to drop by the amount of the dividend when the stock goes ex-dividend.
- Because the final stock price will be lower, dividends decrease the value of a call option.
- If $\mathrm{PV}(Div)$ is the present value of any dividends paid prior to the expiration of the option, then:
  - where S^x is the price of the stock excluding any dividends

$$S^x = S - PV(Div)$$

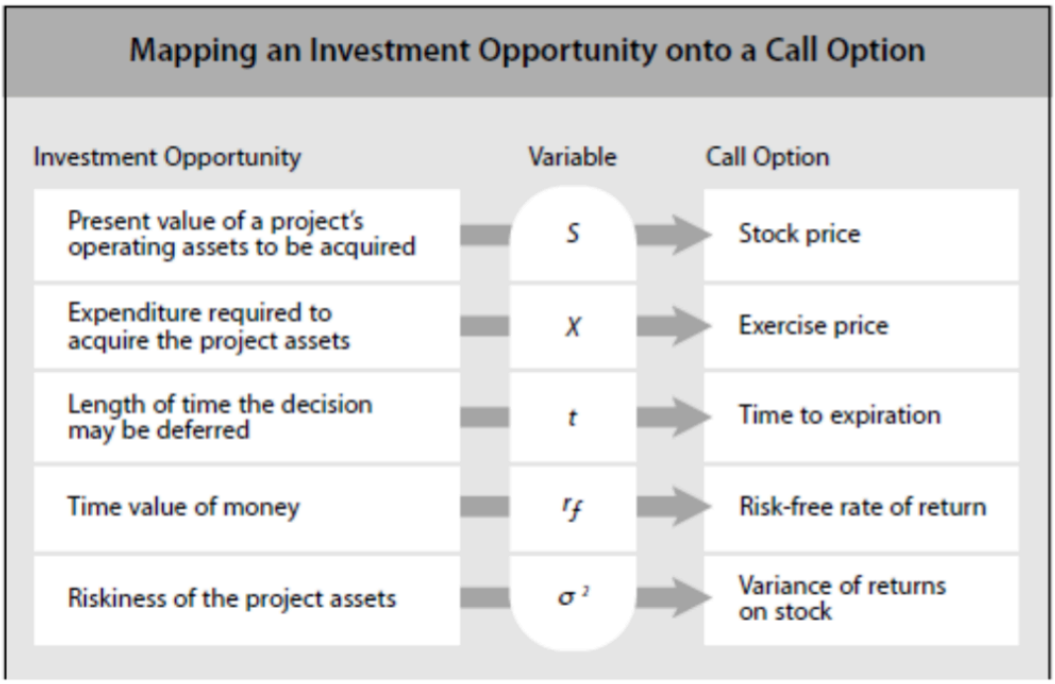
- Because a European call option is the right to buy the stock without these dividends, it can be evaluated by using the Black-Scholes formula with S^x in place of S.

Lecture 6 - Real Options (get fucked)

- Real options are the **right to make a particular business decision**, such as a capital investment.
- A key distinction between real options and financial options is that real options, and the underlying assets on which they are based, are not traded in competitive markets.
- They can be **analysed by creating a decision tree** that identifies decision nodes for choices at each stage, information nodes for payoff relevant information to be learned and investments made and payoffs earned over time.
- **Future growth opportunities** can be thought of as a **collection of real call options** on potential projects.

Types of Real Options

- Investment Options: to invest now or delay.
  - Advantages of waiting are that you will learn more about the likely success of the business. Other factors include:
    - Volatility and Dividends
  - However, whether it is optimal depends on the magnitude of lost profits from the first year compared to the benefit of preserving your right to change your decision.
  - For the diagram **below**, note that any lost cash flows can be included as a dividend.



- Growth Option: an option to invest in the future.
  - NPV with growth option = NPV without growth option + PV of growth option
- Abandonment Option: an option to disinvest.
  - Many times, abandoning an economically unsuccessful venture to derive salvage value can add more value than starting a new one. Managers often de-emphasise this alternative.

Rules of Thumb

- One of the major drawbacks of using real option analysis is that it can be difficult to implement.
  - Many firms resort to following rules of thumb to compare against the NPV ranking.

Profitability Index Rule

- Recommends investment whenever the profitability index exceeds some predetermined number, usually at least 1.

$$\text{Profitability Index} = \frac{\text{NPV}}{\text{Initial Investment}}$$

Hurdle Rate Rule

- Raises the discount rate by using a higher discount rate than the cost of capital to compute the NPV, but then applies the regular NPV rule.

$$\text{Hurdle Rate} = \text{Cost of Capital} + \text{Risk Premium}$$

- IRR is the rate at which the project breaks even. If a project has an IRR > Hurdle Rate, then it should be undertaken.
- Using a hurdle rate rule is cost effective but does not provide an accurate measure of value.
- NPV sing the appropriate cost of capital is an accurate measure of value.

Insights from Real Options

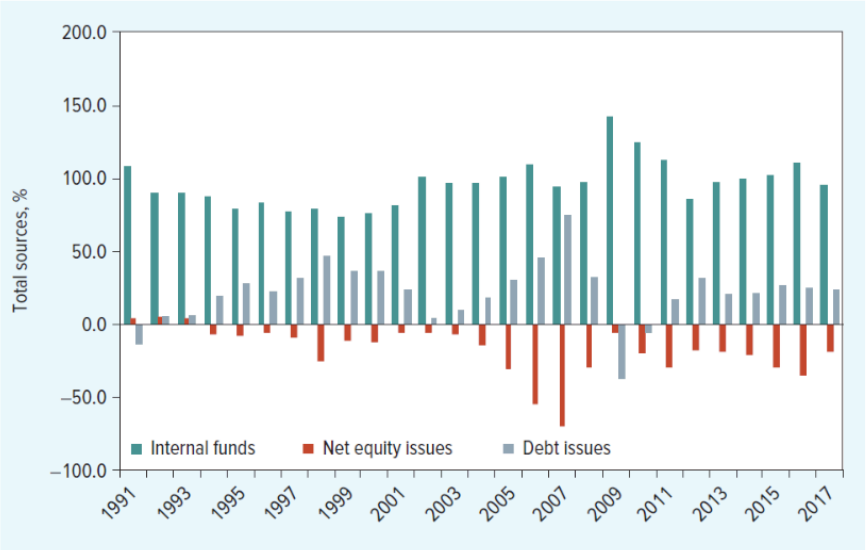
- Out-of-the-money real options have value.
    - Even if an investment has a negative NPV, if there is a chance it could be positive in the future, the opportunity is worth something today.
- In-the-money real options need not be exercised immediately.
    - The option to delay may be worth more than the NPV of undertaking the investment immediately.
- Waiting is valuable.
    - By waiting for uncertainty to resolve, you can make better decisions.
- Delay investment expenses as much as possible.
    - Committing capital before it is absolutely necessary gives up the option to make a better decision once uncertainty is resolved.
- Create value by exploiting real options
    - The firm must continually revaluate its investment opportunities, including the options to delay or abandon projects, as well as to create or grow them.

Practical Challenges of Real Options

- Valuation of real options can be complex, and sometimes it is impossible to arrive at the “perfect" answer.
- Real options do not always have a clear structure for their path and cash flows.
- Competitors also have real options that can alter the value of your options by altering the underlying assumptions and environment that serve as the basis of your valuation (gaming of real options).
- Given these limitations, real options are not always the best approach when valuing projects.

Lecture 7 - Corporate Financing, Securities and their Issue

- Firms may raise funds either by debt or equity external financing, or plowing back profits rather than distribute to shareholders.
    - **Internal funds**: retained earnings plus depreciation.



External Financing

Equity

- investor buys a part of the company, and are entitled to **control rights (voting)** and **cash flow rights (not guaranteed)**.
    - Many US companies have a board of directors that comes up for re-election every year.
    - Some companies have two classes of stock, with the same cash-flow rights, but with differen control rights (that grant private benefits).

Preferred Stock

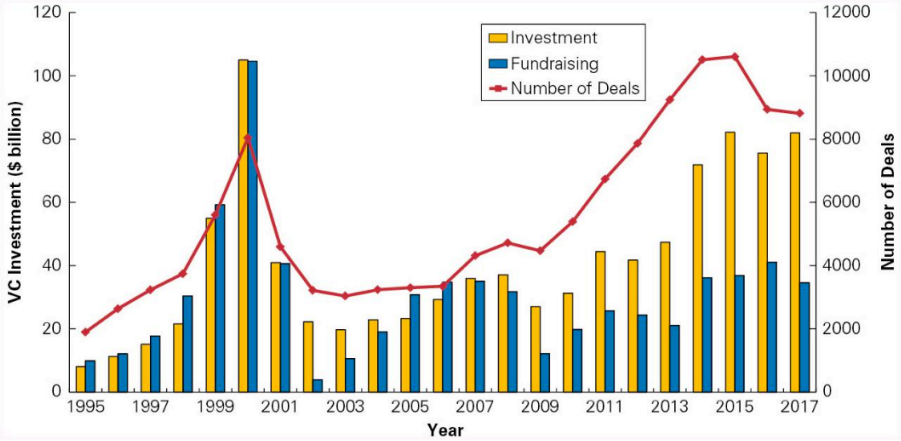
- Takes priority over common stock when receiving dividends.
    - Gains some voting rights if the corporation fails to pay preferred dividend.
- Preferred stock issued by mature companies usually have a preferential dividend and seniority in any liquidation and sometimes special voting rights.

Venture Capital

- The intial capital that is required to start a business is usually provided by the entrepreneur and the immediate family.
- Often, a private company must seek outside sources that can provide additional capital for growth.
    - It is important to understand how the infusion of outside capital will affect the control of the company.

Types of Venture Capital

- **Angel Investors:** individual investors who buy equity in small private firms → finding angels is typically difficult.
- **Venture Capital Firm:** a limited partnership that specialises in raising money to invest in the private equity of young firms.
    - Venture Capitalists: one of the general partners who work for and run a venture capital firm.



Convertible Preferred Stock

- Preferred stock that gives the owner an option to convert it into common stock on some future date.

Example

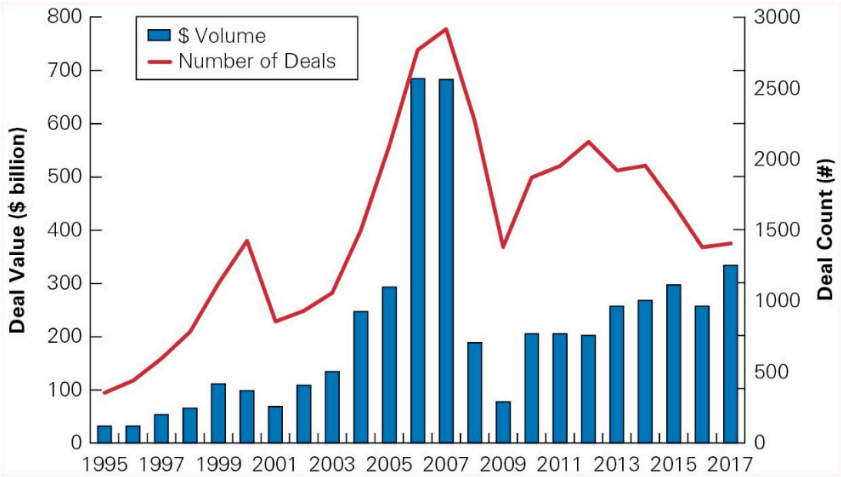
- Initial Investment $1 million of Series A preferred stock at a purchase price of $0.07, representing 13,713,439 shares.
- Additional capital raised by selling equity in the form of convertible preferred stock.
    - 2,686,567 Series B preferred stock at $0.67 per share.

	Number of Shares	Price per Share ($)	Total Value ($ million)	Percentage Ownership
Series A	13,713,439	0.67	9.2	83.6%
Series B	2,686,567	0.67	1.8	16.4%
	16,400,006		11.0	100.0%

- **Pre-Money Valuation**: at the issuance of new equity, the value of the firm's prior shares outstanding at the price in the funding round i.e. $9.2 million.
- **Post-Money Valuation**: at the issuance of new equity, the value of the whole firm (old plus new shares) at the price at which the new equity sold i.e. $11 million.
- **Exit Strategy**: details how investors will eventually realise the return from their investment.

Private Equity

- Organised very much like a venture capital firm, but it invests in the equity of existing privately held firms rather than start-up companies.
- They initiate their investment by finding a poorly performing publicly traded firm and purchasing the oustanding equity, thereby taking the company private in what is called a **leveraged buyout**.
    - In most cases, the private equity firm uses debt as well as equity to finance the purchase.



Going Public

Company Name	Offer Date	Exchange	Industry	Underwriter	Deal Size (in $ million)
Alibaba Group Holding	09/18/2014	NYSE	Technology	Credit Suisse	$21,767
Visa	03/18/2008	NYSE	Financial	J.P. Morgan	$17,864
ENEL SpA	11/01/1999	NYSE	Utilities	Merrill Lynch	$16,452
Facebook	05/17/2012	Nasdaq	Technology	Morgan Stanley	$16,007
General Motors	11/17/2010	NYSE	Capital Goods & Services	Morgan Stanley	$15,774
Deutsche Telekom	11/17/1996	NYSE	Communications	Goldman Sachs	$13,034
AT&T Wireless Group	04/26/2000	NYSE	Communications	Goldman Sachs	$10,620
Kraft Foods	06/12/2001	NYSE	Consumer	Credit Suisse	$8,680
France Telecom	10/17/1997	NYSE	Communications	Merrill Lynch	$7,289
Telstra Corporation	11/17/1997	NYSE	Communications	Credit Suisse	$5,646
Swisscom	10/04/1998	NYSE	Communications	Warburg Dillon Read	$5,582
United Parcel Service	11/09/1999	NYSE	Transportation	Morgan Stanley	$5,470

- **Initial Public Offering (IPO)**: the process of seeling stock to the public for the first time.
    - Advantages
        - Greater liquidity - private equity investors also get the ability to diversify.
        - Better access to capital - through public markets
    - Disadvantages
        - Equity holders become more widely dispersed - more difficult to monitor management.

        - Must satisfy all requirements of public companies - regulatory filings, legal compliance etc.

- **Primary Offering**: new shares available in a public offering that raises new capital.
- **Secondary Offering**: shares sold by existing shareholders in an equity offering.
- **Underwriter**: an investment banking firm that manages a security issuance and designs its structure.
- **Best Efforts Basis**: for smaller IPOs, an underwriter does not guarantee that the stock will be sold, but tries to sell the stock for the best possible price.
    - Often have all-or-none clauses, all sold or IPO called off.
- **Firm Commitment**: agreement between underwriter and issuing firm in which the underwriter guarantees that it will sell all of the stock at the offer price.
- **Auction IPO**: rather than setting a price and allocating shares to buyers, the underwriter in an auction IPO takes bids from investors and sets a price that clears the market.

Debt

- Debt has the feature of allowing the borrowers to walk away from their obligation to pay in exchange for the assets of the company.
    - Default risk is the term used to describe the likelihood that a firm will walk away from its obligations, either voluntarily or involuntarily.
    - Bond ratings are issued on debt instruments to help investors assess the default risk of a firm.
- Corporate bonds almost always pay c**oupons semiannually**, although a few corporations have issued zero-coupon bonds.
    - Most corporate bonds have maturities of 30 years or less.
- The **face value** or principal amount of a bond is denominated in standard increments, most often $1000.
    - The face value does not always correspond to the actual money raised because of underwriting fees and/or if the bond is issued at a discount.
- **Original Issue Discount Bond**: Describes a bond that is issued at a discount to entice buyers to their products

The Prospectus

- Public bond issue similar to stock issue. Indenture is included in a prospectus, and is a formal contract between bond issuer and a trust company.
    - Trust company represents bondholders and makes sure that terms of indenture are enforced.
    - Trust company responsible for registration, transfer, and payment of bonds.
    - In the case of default, trust company represents the interests of the bond holders.

Bond Indenture

- **Restrictive Covenants:**
    - Equity holders have last claim in the event of bankruptct. However, they also elect management, who will tend to act in the best interest of shareholders.
        - Creates a conflict of interest between ordinary shareholders and creditors.
    - Restrictive covenants are placed in the bond indenture to protect the bondholders' interests.

- Negative covenants limit or prohibit the company from taking certain actions like paying huge dividends to stockholders.
- Affirmative covenants specify certain duties on the company such as maintaining a minimum level of net worth, or working capital. These have to be exhaustive, as courts have held that only written covenants count.

Types of Debt

- **Unsecured Debt:** corporate debt that, in the event of bankruptcy, gives bondholders a claim to only the assets of the firm that are not already pledged as collateral on other debt.
  - Notes: coupon bonds with maturities shorter than 10 years.
  - Debentures: longer maturities than notes.
- **Secured Debt**: specific assets are pledged as collateral.
  - Mortgage Bonds: real property pledged that bondholders have direct claim on in event of bankruptcy - all classes of securities paid from the same CF source.
  - Asset-Backed Bonds: specific assets pledged that bondholders have direct claim on in event of bankruptcy.

Tranches

- Different classes of securities that comprise a single bond issue.
- All classes of securities are paid from the same CF source.

	Senior Dollar-Denominated Note	Senior Euro-Denominated Note	Subordinated Dollar-Denominated Note
Face Value	$ 1.8 billion	€ 225 million	$600 million
Maturity	December 1, 2014	December 1, 2014	December 1, 2016
Coupon	8.875%	7.875%	10.5%
Issue price	Par	Par	Par
Yield	8.875%	7.875%	10.5%
Call features	Up to 35% of the outstanding principal callable at 108.875% in the first three years.	Up to 35% of the outstanding principal callable at 107.875% in the first three years.	Up to 35% of the outstanding principal callable at 110.5% in the first three years.
	After four years, fully callable at: • 104.438% in 2010 • 102.219% in 2011 • Par thereafter	After four years, fully callable at: • 103.938% in 2010 • 101.969% in 2011 • Par thereafter	After five years, fully callable at: • 105.25% in 2011 • 103.50% in 2012 • 101.75% in 2013 • Par thereafter
Settlement	**December 21, 2005**	**December 21, 2005**	**December 21, 2005**
Rating			
Standard & Poor's	B	B	B
Moody's	B1	B1	B3
Fitch	BB–	BB–	B+

Other Definitions

- **Seniority:** bondholder's priority in claiming assets not already secured by other debt.
  - Most debenture issues contain clauses restricting the company from issuing new debt with equal or higher priority than existing debt.
  - Subordinated Debentures: debt that, in the event of a default, has a lower priority claim to the

firm's assets than other outstanding debt.

- **Private Debt**: not publicly traded, that has the advantage that it avoids the cost of registration but has the disadvantage of being illiquid.
    - Private Placements: bond issue to small group of investors often debt tradable between financial institutions.
- **Term Loans**: a bank loan that lasts for a specific term.
    - Syndicated Bank Loan: single loan that is funded by a group of banks rather than just a single bank.
    - Revolving Line of Credit: a credit commitment for a specific time period, typically two to three years, which a company can use as needed.
- **Repayment**: a bond issuer typically repays its bonds by making coupon and principal payments as specified in the bond contract. The issuer can however:
    - Repurchase a fraction of the outstanding bonds in the market.
    - Make a tender offer for the entire issue.
    - Exercise a **call** provision.
        - **Callable Bonds**: bonds that contain a call provision that allows the issuer to repurchase the bonds at a predetermined price.

Convertible Bond

- Corporate bond with a provision that gives the bondholder an option to convert each bond into a fixed number of shares of common stock.
- **Conversion Ratio**: number of shares received upon conversion of a convertible bond, usually stated per $1000 of face value.
- **Conversion Price**: face value of a convertible bond divided by conversion ratio.
- **Conversion Value**: Conversion Ratio $\times$ Current Share Price

> Assume you have a convertible bond with a $1000 face value and a conversion ratio of 15.
>
> - If you convert the bond into stock, you will receive 15 shares.
> - If you do not convert, you will receive $1000.
>   - By converting you essentially “pay” $1000 for 15 shares, implying a price per share of $66.67.
>   - If the price of the stock exceeds $66.67, you will choose to convert; otherwise, you will take the cash.

Topic 8 - Capital Structure in a Perfect Market

- **Capital structure** is the relative proportion of debt, equity, and other securities that a firm has outstanding.
    - Financial managers try to find the combination of securities that has the greatest appeal to investors/maximise the market value of the firm.

Effective of Leverage on Risk and Return

- Leverage **increases the risk** of equity of a firm.
    - Unlevered equity discounted at 15%. **Levered equity investors will require a higher expected return** to compensate for the increased risk. In this case they expect 25%.

	Date 0	Date 1: Cash Flows		Date 1: Returns		
	Initial Value	Strong Economy	Weak Economy	Strong Economy	Weak Economy	Expected Return
Debt	\$500	\$525	\$525	5%	5%	5%
Levered equity	\$500	\$875	\$375	75%	−25%	25%
Unlevered equity	\$1000	\$1400	\$900	40%	−10%	15%

- Leverage increases the risk of equity even when there is no risk of default.
    - Debt may be cheaper, but its use raises the cost of capital for equity. **NOTE:** considered together, the average cost of capital is the same for both levered and unlevered firms.

Modigliani-Miller I (no tax)

Perfect Capital Markets Conditions

- Investors and firms can trade the same set of securities at competitive market prices equal to the present value of their future cash flows $\rightarrow$ this also means they can access the same interest rates.
- There are **no taxes, transaction costs, or issuance costs** associated with security trading.
- A firm's **financing decisions do not change the cash flows** generated by its investments, nor do they reveal new information about them.

Definition

- In a perfect capital market, **changes in capital structure do not affect the total value of the firm**.
    - In essence, the total value of the firm is equal to the **total cash flows generated by its assets**, equal the **total cash flows paid out to security holders**.
    - U : market value of EQUITY in UNLEVERED firm. A : market value of firm's ASSETS.
    - E : market value of EQUITY in a LEVERED FIRM. D : market value of DEBT in a LEVERED firm.

$$U = A = E + D$$

- **Leverage changes the allocation of cash flows** between debt and equity, without altering the total cash flows/value of the firm, derived from the Law of One Price.
    - Cash flows from holding unlevered equity can be replicated using **homemade leverage** i.e.

holding a portfolio of firm's equity and debt.

Implications

- Share prices is constant regardless of how much leverage there is.
- Firm value is the total cash flows generated by its assets (note that WACC is constant). This can be represented as:

$$\text{Firm Value} = \frac{\text{EBIT(1-t)}}{\text{WACC}}$$

Homemade Leverage

- Investors use leverage in their own portfolios to adjust the leverage choice made by a FIRM.
    - MM demonstrated that if investors preferred an alternative capital structure, they can borrow or lend on their own to achieve the same result.
- Consider an all-equity firm and an investor that prefers to hold levered equity. They can achieve this by taking on debt themselves.

	Date 0	Date 1: Cash Flows	
	Initial Cost	Strong Economy	Weak Economy
Unlevered equity	\$1000	\$1400	\$900
Margin loan	−\$500	−\$525	−\$525
Levered equity	\$500	\$875	\$375

Modigliani-Miller I (with tax)

The Interest Tax Shield

- Interest expenses reduce the amount of corporate tax, creating an incentive to use debt.
    - Although debt obligations reduce the value of equity, the total amount available to investors is higher with leverage i.e. the value of the firm is higher.

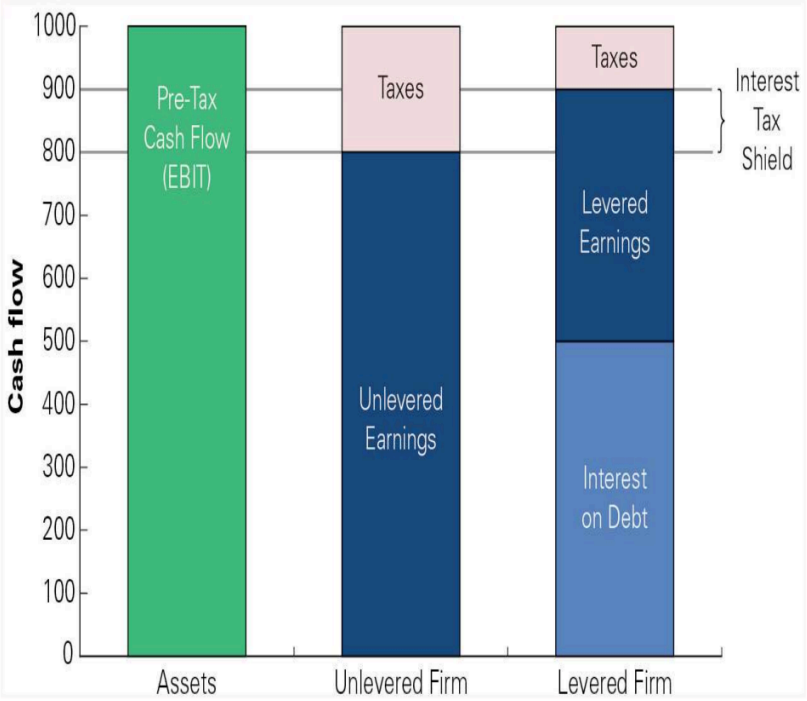
	With Leverage	Without Leverage
EBIT Interest expense	\$2800 −400	\$2800 0
Income before tax Taxes (35%)	2400 −840	2800 −980
Net income	\$1560	\$1820

	With Leverage	Without Leverage
Interest paid to debt holders Income available to equity holders	400 1560	0 1820
Total available to all investors	\$1960	\$1820

- **Interest Tax Shield**: The reduction in taxes paid i.e. 980 - 840 = 140, due to the tax deductabilty of interest.

$$\text{Interest Tax Shield} = \text{Corporate Tax Rate} \times \text{Interest Payments}$$

- In this case, Interest Payments can be calculated using: $\text{Interest Rate} \times \text{Total Debt}$



- When a firm uses debt, the interest tax shield provides a corporate tax benefit each year.
    - Computed as the present value of the stream of future interest tax shields the firm will receive.

Definition

- Having said this, **the total value of the levered firm exceeds the value of the firm without leverage due to the present value of tax savings from debt**:
    - The Interest Tax Shield is discounted by the

$$V^L = V^U + \text{PV}(\text{Interest Tax Shield})$$

- Level of future interest payments is uncertain due to changes in marginal tax rate, debt outstanding, interest rate, risk etc.
    - Holding these constant, let's suppose a firm borrows **debt D and keeps it permanently**. The tax shield is now viewed as a **perpetuity**:

$$PV(\text{Interest Tax Shield}) = \frac{\tau_c \times \text{Interest}}{r_f} = \frac{\tau_c \times (r_f \times D)}{r_f}$$
$$= \tau_c \times D$$

Modigliani-Miller II (no tax)

Definition

- Given:
  - R_U : return on unlevered equity
  - R_E : return on levered equity
  - R_D : return on debt

$$\frac{E}{E+D}R_E + \frac{D}{E+D}R_D = R_U$$

- Rearranging:

$$R_E = \underbrace{R_U}_{\substack{\textit{Risk without} \\ \textit{leverage}}} + \underbrace{\frac{D}{E}(R_U - R_D)}_{\substack{\textit{Additional risk} \\ \textit{due to leverage}}}$$

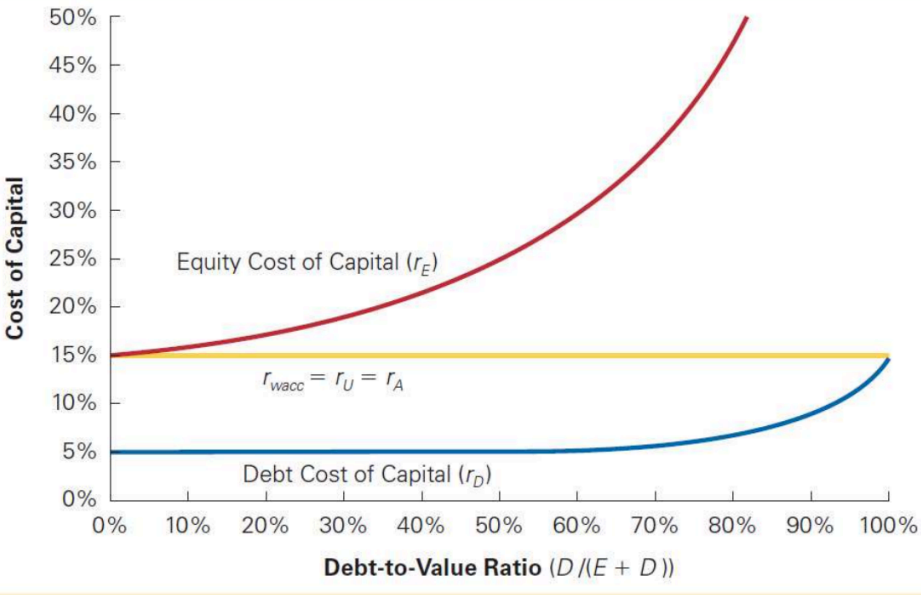
- **MM2:** The cost of capital of levered equity is equal to the cost of capital of unlevered equity plus a premium that is proportional to the market value D/E.

Implications

- If a firm is unlevered, all FCFs generated by assets are paid to equity holders. Therefore, $R_U = R_{WACC}$.
- The value of levered and unlevered firms are the same. Therefore, where R_A is the rate of return of a levered firm:

$$R_U = R_{WACC} = R_A$$

- **TAKEAWAY: A Firm's WACC is independent of its capital structure.**
  - Looking at the R_E equation above, if R_U is constant, and R_D is constant, R_E is proportional to $\frac{D}{E}$, which makes sense given that leverage increases the return on equity.
  - R_D increases as leverage increases due to default risk.



(a)

E	D	r_E	r_D	$\frac{E}{E+D}r_E + \frac{D}{E+D}r_D$	$= r_{wacc}$
1000	0	15.0%	5.0%	$1.0 \times 15.0\% + 0.0 \times 5.0\%$	$= 15\%$
800	200	17.5%	5.0%	$0.8 \times 17.5\% + 0.2 \times 5.0\%$	$= 15\%$
500	500	25.0%	5.0%	$0.5 \times 25.0\% + 0.5 \times 5.0\%$	$= 15\%$
100	900	75.0%	8.3%*	$0.1 \times 75.0\% + 0.9 \times 8.3\%$	$= 15\%$

(b)

Modigliani-Miller II (with tax)

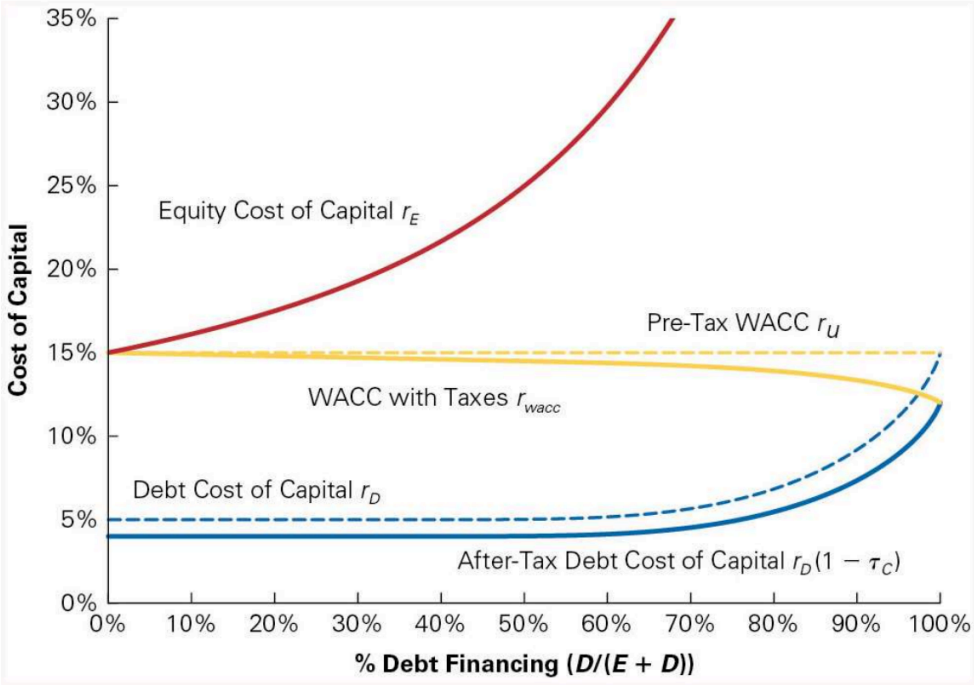
- With the tax-deductible interest, the effective after-tax borrowing rate is $r(1-t)$ and the WACC becomes:

$$r_{Wacc} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D (1 - \tau_c)$$

$$r_{Wacc} = \underbrace{\frac{E}{E+D} r_E + \frac{D}{E+D} r_D}_{\text{Pretax WACC}} - \underbrace{\frac{D}{E+D} r_D \tau_c}_{\substack{\text{Reduction Due} \\ \text{to Interest Tax Shield}}}$$

- **NOTE:** The R_E formula now contains a $(1-t)$ term for the additional risk component.

Implications



Leverage in Terms of Beta

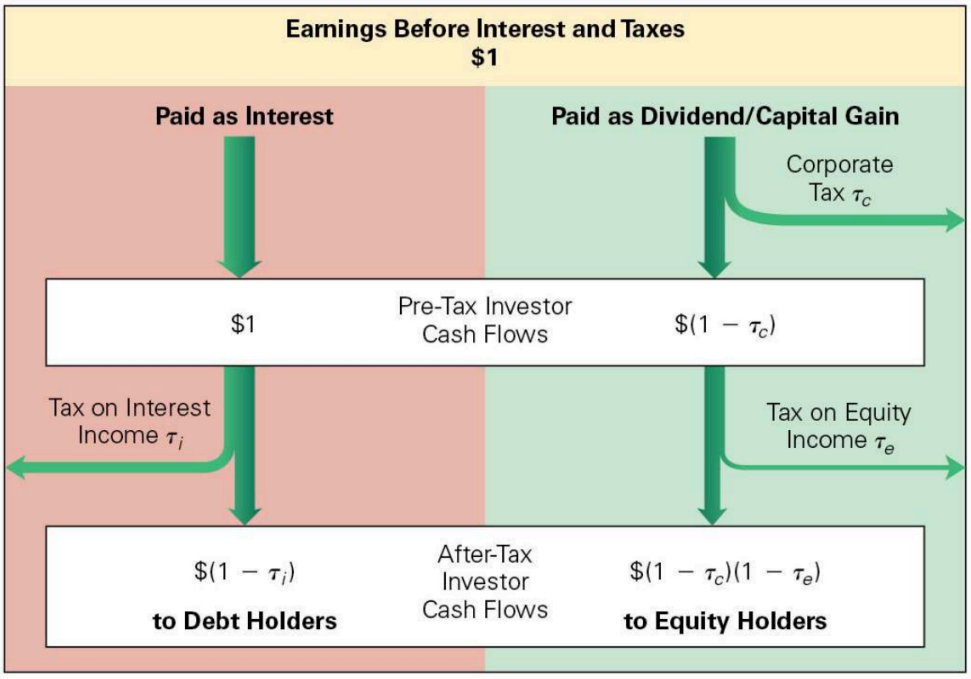
- The effect of leverage on the risk of a firm's securities can also be expressed in terms of beta.

$$\beta_U = \frac{E}{E+D}\beta_E + \frac{D}{E+D}\beta_D$$

- **Unlevered Beta:** a measure of the risk of a firm as if it did not have leverage, which is equivalent to the beta of the firm's assets.
    - Estimating unlevered beta for investment project should be done off unlevered betas of firms with comparable investments.
- Leverage amplifies the market risk of a firm's assets, β_U, raising the market risk of its equity.

Personal Taxes

- Cash flows to investors are typically taxed twice.
    - Once at corporate level, and then investors are taxed again when they receive their interest and dividend payments.
- Personal taxes reduce the cash flows to investors and can offset some of the corporate tax benefits of leverage.
    - Actual interest tax shield depends on both corporate and personal taxes that are paid.



- In general, the **Effective Tax Advantage of Debt** is equal to:

$$\tau^* = \frac{(1-\tau_i) - (1-\tau_c)(1-\tau_e)}{(1-\tau_i)} = 1 - \frac{(1-\tau_c)(1-\tau_e)}{(1-\tau_i)}$$

- No personal taxes on debt OR taxes on interest and income are the same, then Effective Tax Advantage of Debt is equal to the corporate tax rate.
- When equity income is taxed less heavily than interest income, then the tax advantage is also reduced.

Personal Taxes and Permanent Debt

- The **value of the firm with leverage** becomes:

$$V^L = V^U + \tau^* D$$

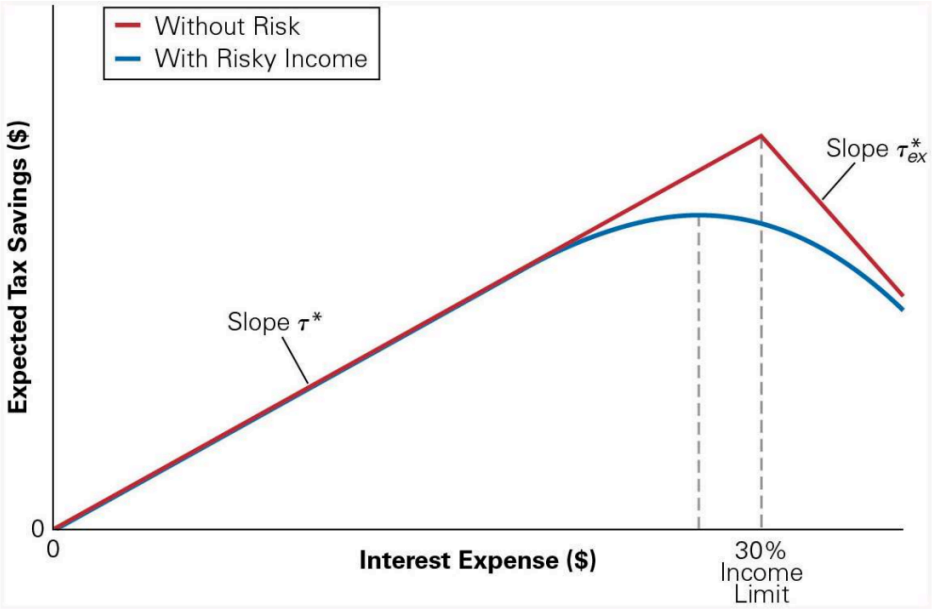
- When the tax advantage is less than the corporate tax rate, the benefit of leverage is reduced in the presence of personal taxes.

Actual Tax Advantage of Debt

- It's assumed that investors pay the top marginal federal income tax rates.
- In reality, rates vary for individual investors, and many face lower rates (effect of personal taxes are less substantial).
    - Many face no taxes e.g. retirement savings accounts.
- At the end of the day, the effective tax advantage of debt is extremely difficult to find since a firm needs to consider the tax bracket of it's typical debt holders, and tax bracket and holding period of typical equity holders.

Limits to the Benefit of Debt

- The optimal level of leverage from a tax saving perspective is the level such that interest equals EBIT. In this case, no taxable income exists.
- However, it is unlikely that a firm can predict its future EBIT and optimal level of debt precisely.
    - If interest exceeds EBIT, the tax savings for high levels of interest falls.
- In general, as a firm's interest expense approaches its expected taxable earnings, the marginal tax advantage of debt declines, limiting the amount of debt the firm should use.



Debt Usage in Practice

- The use of debt varies greatly by industry.
    - Firms in growth industries like biotechnology or high technology carry very little debt, while airlines, automakers, utilities and financial firms have high leverage ratios.
- Firms generally prefer to use internal funds, then debt, and equity last.
    - It appears however that firms on average are under-leveraged. This is because of bankruptcy costs etc.

Lecture 9 - Financial Distress, Managerial Incentives, and Information

- **Financial Distress:** When a firm has difficulty meeting its debt obligations.

- **Default (Bankruptcy)**: When a firm fails to make required interest or principal payments on its debt or violates a debt covenant.
    - After the firm defaults, debt holders are given certain rights to assets of the firm and may even take legal ownership of firm's assets through bankruptcy.
- The risk of bankruptcy is an important consequence of leverage that equity financing does not carry.
    - Although equity holders hope to receive dividends, the firm is not legally obligated to pay them.

Financial Distress Example

- Considering the following example, with **$100 million debt due**.
    - If the new product fails, Armin will experience **economic distress**, which is a significant decline in the value of a firm's assets, whether or not it experiences financial distress from leverage.
    - If firm has access to capital markets and can issue new securities at a fair price, then it need not default as long as market value of its assets exceeds its liabilities.
    - **NOTE**: ignoring bankruptcy costs, the **decline in value is the same** regardless of leverage (150 to 80 vs 50 to 0 AND 100 to 80)

	Without Leverage		With Leverage	
	Success	Failure	Success	Failure
Debt value	—	—	100	80
Equity value	150	80	50	0
Total to all investors	150	80	150	80

NO DEFAULT DEFAULT

Bankruptcy and Capital Structure

- **MM1:** The total value to all investors does not depend on the firm's capital structure.
    - There is no disadvantage to debt financing, and a firm will have the same total value and will be able to raise the same amount initially from investors with either choice of capital structure.
- With **perfect capital markets**, the risk of bankruptcy is not a disadvantage of debt; rather, **bankruptcy shifts the ownership of the firm from equity holders to debt holders** without changing the total value available to all investors.
    - In reality, bankruptcy is rarely simple and straightforward. It is often a long and complicated process that imposes both direct and indirect costs on the firm and its investors.
        - Direct: outside experts hired to assist with bankruptcy process.
        - Indirect: loss of customers, loss of suppliers, loss of employees, fire sale of assets, increased agency costs from risk shifting, underinvestment/refusal to invest more equity, cash in and run, bait and switch, playing for time.

The Tradeoff Theory

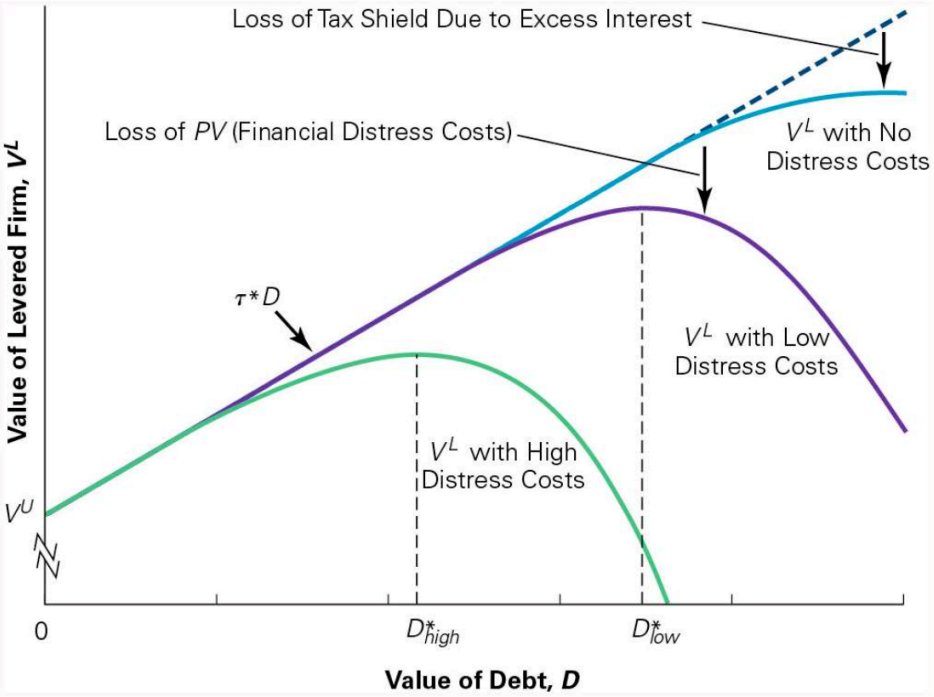
- The firm picks its capital structure by trading off the benefits of the tax shield from debt against the costs of financial distress and agency costs.
- According to the Tradeoff Theory, the total value of a levered firm equals the value of the firm without leverage plus the present value of the tax savings from debt, less the present value of financial distress costs:

$$V^L = V^U + \text{PV}(\text{Interest Tax Shield}) - \text{PV}(\text{Financial Distress Costs})$$

- **Probability of financial distress increases with the amount of a firm's liabilities** (relative to its assets) and volatility of firm's cash flows and asset values.

Optimal Leverage

- For low levels of debt, the risk of default remains low, and the main effect of an increase in leverage is an increase in the interest tax shield.
- As the level of debt increases, the probability of default increases.
    - As the level of debt increases, the costs of financial distress increase, reducing the value of the levered firm.
- **The Tradeoff Theory** states that firms should increase their leverage until it reaches the level for which the firm value is maximized.
    - At this point, the tax savings that result from **increasing leverage are perfectly offset by the increased probability of incurring the costs of financial distress**.
- It can also help explain:
    - Why firms choose debt levels that are too low to fully exploit the interest tax shield (due to the presence of financial distress costs).
    - Differences in the use of leverage across industries (due to differences in the magnitude of financial distress costs and the volatility of cash flows).



Agency Costs of Leverage

- **Agency Costs**: Costs that arise when there are conflicts of interest between the firm's stakeholders.
- Management will generally make decisions that increase the value of the firm's equity.
    - When the firm has leverage, managers may make decisions that **benefit shareholders** but **harm firm's creditors and lower the total value of the firm** i.e. **take negative NPV projects.**
- **Cashing Out**: When a firm faces financial distress, shareholders have an incentive to withdraw money from the firm, if possible.
    - For example, if it is likely the company will default, the firm may sell assets below market value and use the funds to pay an immediate cash dividend to the shareholders.
        - This is another form of **under-investment** that occurs when a firm faces financial distress.

Agency Cost Example

- In this case, market value of assets is $900k, loan due at the end of the year is $1million.
    - Project can be taken with 50% chance of success, earning either $1.3 million, or $300k.

		New Risky Strategy		
	Old Strategy	Success	Failure	Expected
Value of assets	900	1300	300	800
Debt	900	1000	300	650
Equity	0	300	0	150

- Even though the firm's value has a negative expected payoff, because of inevitable default, **shareholders earn nothing with certainty given no action** $\rightarrow$ they have nothing to lose, and will pressure managers to take the project.
    - The debt holders $250,000 loss corresponds to the $100,000 expected **decline in firm value** due

to the risky strategy and the equity holder's $150,000 gain.

- **Asset Subsitution Problem**: When a firm faces financial distress, shareholders can gain at the expense of debt holders by taking a negative-NPV project, if it is sufficiently risky.
    - Shareholders have an incentive to invest in negative-NPV projects that are risky, even though a negative-NPV project destroys value for the firm overall.
        - Anticipating this bad behavior, security holders will pay less for the firm initially.

Agency Cost Example II

- Consider an investment opportunity needing an initial investment of $100,000 and will generate risk-free return of 50%.
    - If the current risk-free rate is 5%, this investment has a **positive NPV**. Without cash on hand, company raises $100,000 in new equity.

	Without New Project	With New Project
Existing assets	900	900
New project		150
Total firm value	900	1050
Debt	900	1000
Equity	0	50

- If equity holders contribute $100k to fund, they only get back $50k.
    - Other $100k goes to debt holders, whose payoff increases by that amount.
    - The debt holders receive most of the benefit, thus this project is a negative-NPV investment opportunity for equity holders, even though it offers a positive NPV for the firm.
- **Debt Overhang or Under-Investment Problem**: A situation in which equity holders choose not to invest in a positive NPV project because the firm is in financial distress and the value of undertaking the investment opportunity will accrue to bondholders rather than themselves.

Debt Maturity and Covenants

- The magnitude of agency costs often depends on the maturity of debt.
    - Agency costs are **highest for long-term debt** and **smallest for short-term debt.**
- **Debt Covenants**: Conditions of making a loan in which creditors place restrictions on actions that a firm can take.
    - Covenants may help to reduce agency costs; however, because covenants hinder management flexibility, they have the potential to prevent investment in positive NPV opportunities and can have costs of their own.

Agency Benefits of Leverage

- **Management Entrenchment**
  - A situation arising as the result of the separation of ownership and control in which managers may make decisions that benefit themselves at investors' expenses.
  - Agency benefit of leverage is that it may help to reduce entrenchment through disciplinary effects on management through interest obligations
- **Concentration of Ownership**
  - Allows original owners of the firm to maintain their equity stake.
  - As major shareholders, they will have a strong interest in doing what is best for the firm
  - By issuing **new equity**, the firm incurs the **agency costs** of reduced effort and excessive spending on perks.
- **Wasteful Investment**: managers may make large, unprofitable investments.
  - **Empire Building:**
    - Managers often prefer to run larger firms rather than smaller ones, so they will take on investments that increase the size, but not necessarily the profitability, of the firm.
    - Managers of large firms tend to earn higher salaries, and they may also have more prestige and garner greater publicity than managers of small firms.
    - Thus, managers may expand unprofitable divisions, pay too much for acquisitions, make unnecessary capital expenditures, or hire unnecessary employees.
  - **Over-Invest/Overconfidence**:
    - Even when managers attempt to act in shareholders' interests, they may make mistakes.
    - Managers tend to be bullish on the firm's prospects and may believe that new opportunities are better than they actually are.
- CONTINUING FROM WASTEFUL INVESTMENT **Free Cash Flow Hypothesis**
  - Wasteful spending is more likely to occur when firms have high levels of cash flow in excess of what is needed after making all positive-NPV investments and payments to debt holders.
  - When cash is tight, managers will be motivated to run the firm as efficiently as possible.
    - According to the free cash flow hypothesis, leverage increases firm value because it commits the firm to making future interest payments, thereby reducing excess cash flows and wasteful investment by managers.

ALL TOGETHER

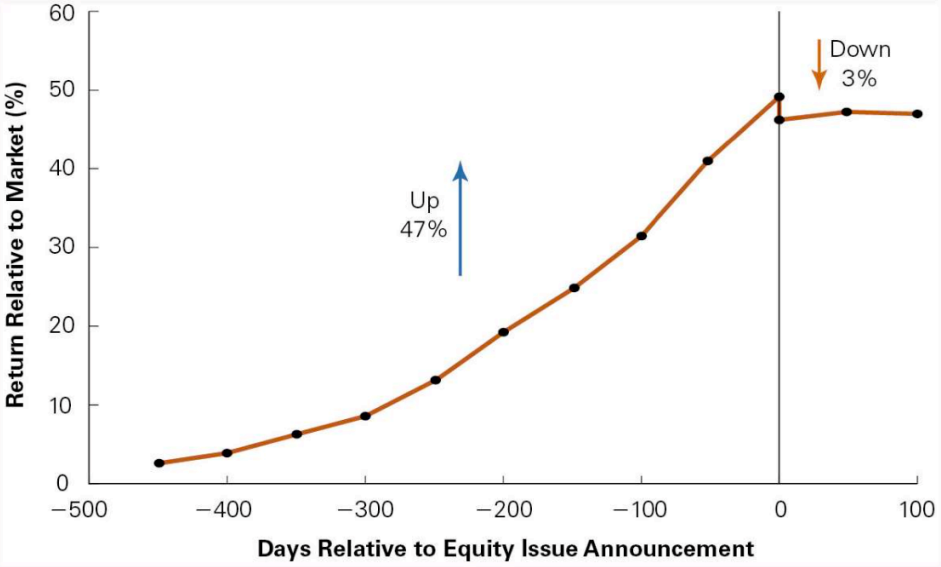
$$V^L = V^U + \text{PV}(\text{Interest Tax Shield}) - \text{PV}(\text{Financial Distress Costs}) \\ -\text{PV}(\text{Agency Costs of Debt}) + \text{PV}(\text{Agency Benefits of Debt})$$

Assymetric Information and Capital Structure

- **Assymetric Information:** A situation in which parties have different information.
    - For example, when managers have superior information to investors regarding the firm's future cash flows.
- **Signalling Theory of Debt**: Use of leverage as a way to signal information to investors and convince investors it does have information that firm will grow.
    - Large new profitable project that can't be discussed for competitive reasons. Credibly communicate this positive information by committing to large future debt payments.
        - Why commit if the information is false and you'll have trouble paying creditors/experience financial distress?

Issuing Equity and Adverse Selection

- **Adverse Selection**: The idea that when the buyers and sellers have different information, the average quality of assets **in the market** will differ from the average quality overall.
- **Lemons Principle**: When a seller has private information about the value of a good, buyers will discount the price they are willing to pay due to adverse selection.
- **Firms that sell new equity have private information about the quality of the future projects.**
    - However, due to the lemons principle, buyers are reluctant to believe management's assessment of the new projects and are only willing to buy the new equity at heavily discounted prices.
    - Therefore, managers who know their prospects are good (and whose securities will have a high value) will not sell new equity.
- Only those managers who know their firms have poor prospects (and whose securities will have low value) are willing to sell new equity.
    - The **lemons problem creates a cost for firms** that need to raise capital from investors to fund new investments.
    - If they try to issue equity, investors will discount the price they are willing to pay to reflect the possibility that managers have bad news.
- ***The Lemon's Principle directly implies the following:***
    - The stock price declines on the announcement of an equity issue.
    - The stock price tends to rise prior to the announcement of an equity issue.
    - Firms tend to issue equity when information asymmetries are minimized, such as immediately after earnings announcements.



Implications for Capital Structure

- Managers who perceive the **firm's equity is underpriced** will have a **preference to fund investment using retained earnings, or debt, rather than equity**. The converse is true.

Pecking Order Hypothesis

- The idea that managers will prefer to fund investments by first using retained earnings, then debt, and equity only as a last resort.
- However, this hypothesis does not provide a clear prediction regarding capital structure.
    - While firms should prefer to use retained earnings, then debt, and then equity as funding sources, retained earnings are merely another form of equity financing.
    - Firms might have low leverage either because they are unable to issue additional debt and are forced to rely on equity financing, or because they are sufficiently profitable to finance all investment using retained earnings.

More stuff on Pecking Order Hypothesis in Topic 9 Additional Notes

Market Timing View of Capital Structure

- The firm's overall capital structure depends in part on the market conditions that existed when it sought funding in the past.

OVERALL:

The optimal capital structure depends on market imperfections, such as taxes, financial distress costs, agency costs, and asymmetric information.

Lecture 10 - Investment and Financing Interaction

Assumptions

- The project has average risk.
- The firm's debt-equity ratio is constant.
- Corporate taxes are the only imperfection.

	Year	0	1	2	3	4
Incremental Earnings Forecast ($ million)						
1	Sales	—	60.00	60.00	60.00	60.00
2	Cost of Goods Sold	—	(25.00)	(25.00)	(25.00)	(25.00)
3	**Gross Profit**	—	35.00	35.00	35.00	35.00
4	Operating Expenses	(6.67)	(9.00)	(9.00)	(9.00)	(9.00)
5	Depreciation	—	(6.00)	(6.00)	(6.00)	(6.00)
6	**EBIT**	(6.67)	20.00	20.00	20.00	20.00
7	Income Tax at 25%	1.67	(5.00)	(5.00)	(5.00)	(5.00)
8	**Unlevered Net Income**	(5.00)	15.00	15.00	15.00	15.00
Free Cash Flow						
9	Plus: Depreciation	—	6.00	6.00	6.00	6.00
10	Less: Capital Expenditures	(24.00)	—	—	—	—
11	Less: Increases in NWC	—	—	—	—	—
12	**Free Cash Flow**	**(29.00)**	**21.00**	**21.00**	**21.00**	**21.00**

Weighted Average Cost of Capital Method

- Assume, firm maintains **constant debt-equity ratio** and **WACC remains constant over time**.

$$r_{wacc} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D (1 - \tau_c)$$

- Because the WACC incorporates the tax savings from debt, we can compute the **levered value** of an investment:

$$V_0^L = \frac{FCF_1}{1 + r_{wacc}} + \frac{FCF_2}{(1 + r_{wacc})^2} + \frac{FCF_3}{(1 + r_{wacc})^3} + \ldots.$$

Summary

The **WACC** can be used throughout the firm as the **companywide cost of capital** for new investments that are of **comparable risk** to the rest of the firm and that **will not alter the firm's debt-equity ratio**.

1. Determine the free cash flow of the investment.
2. Compute the weighted average cost of capital.
3. Compute the value of the investment, including the tax benefit of leverage, by discounting the free cash flow of the investment using the WACC.

Example

Assets		Liabilities		Cost of Capital	
Cash	20	Debt	320	Debt	6%
Existing Assets	600	Equity	300	Equity	10%
Total Assets	620	Total Liabilities and Equity	620		

- Note: Net Debt (D) = 320 - 20 = $300 million.

$$r_{wacc} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D (1 - \tau_c) = \frac{300}{600}(10\%) + \frac{300}{600}(6\%)(1-0.25)$$
$$= 7.25\%$$

- Value of the project including the tax shield from debt is calculated as the present value of its future FCFS.

$$V_0^L = \frac{21}{1.0725} + \frac{21}{1.0725^2} + \frac{21}{1.0725^3} + \frac{21}{1.0725^4} = \$70.73 \text{ million}$$

- The NPV of the project is $41.73 million.

$$\$70.73\text{mmillion} - \$29 \text{ million} = \$41.73 \text{ million}$$

Constant Debt-Equity Ratio

- By taking on the project, Avco adds new assets to the firm with initial market value $70.73 million.
  - To maintain its debt-to-value ratio, Avco must add 50% $\times$ 70.73 = $35.365 million in new debt.
- Avco can add this debt either by reducing cash or by borrowing and increasing debt.
  - Assume Avco decides to spend its $20 million in cash and borrow an additional $15.365 million.
  - Because only $29 million is required to fund the project, Avco will pay the remaining $35.365 million − $29 million = $6.365 million to shareholders through a dividend (or share repurchase).
- The market value of Avco's equity increases by $35.365 million. With the dividend of $6.365 = $41.73 million, we find our NPV.

Assets		Liabilities	
Cash	—	Debt	335.365
Existing Assets	600.00		
RFX Project	70.73	Equity	335.365
Total Assets	670.73	Total Liabilities and Equity	670.73

Debt Capacity

- The amount of debt at a particular date that is required to maintain the firm's target debt-to-value ratio
- The debt capacity at date t is calculated as:
  - Where d is the firm's target debt-to-value ratio and V_t^L is the levered continuation value on date t .

$$D_t = d \times V_t^L$$

- V_t^L is calculated as:

$$V_t^L = \frac{FCF_{t+1} + \overbrace{V_{t+1}^L}^{\text{Value of } FCF \text{ in year } t+2 \text{ and beyond}}}{1 + r_{wacc}}$$

- Therefore, for our example.

	Year	0	1	2	3	4
Project Debt Capacity ($ million)						
1	**Free Cash Flow**	(29.00)	21.00	21.00	21.00	21.00
2	Levered Value, V^L (at r_{wacc} = 7.25%)	70.73	54.86	37.84	19.58	—
3	**Debt Capacity, D_t (at d = 50%)**	**35.37**	**27.43**	**18.92**	**9.79**	—

Adjust Present Value Method (APV)

- A valuation method to determine the levered value of an investment by first calculating its unlevered value and then adding the value of the interest tax shield.

$$V^L = APV = V^U + \text{PV}(\text{Interest Tax Shield}))$$

Summary

- Steps:
  1. Determine the investment's **value without leverage**.
  2. Determine the **present value of the interest tax shield**.
     - Determine the expected interest tax shield.
     - Discount the interest tax shield.
  3. **Add** the unlevered value to the present value of the interest tax shield to determine the value of the investment with leverage.
- **The APV method has some advantages**:
  - It can be easier to apply than the WACC method when the firm **does not maintain a constant debt-equity ratio** BUT knows the amount of debt it has.
  - The APV approach also explicitly **values market imperfections** and therefore allows managers to measure their contribution to value.

- We can easily extend the APV approach to include other market imperfections such as financial distress, agency, and issuance costs.

Example

- **Unlevered Cost of Capital:** For a firm that maintains a target leverage ratio, it can estimated as the pre-tax WACC.
  - They are equal because it represents investors' required return for holding the entire firm (equity and debt).
  - Relies on the **assumption** that the **overall risk of the firm is independent of the choice of leverage**.

$$r_U = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D = \text{Pre-tax WACC}$$

- **Target Leverage Ratio**: when a firm adjusts its debt proportionally to a project's value or its cash flows (where the proportion need not remain constant). A constant market debt-equity ratio is a special case.
- **FOR AVCO:**
  - The unlevered cost of capital is calculated as:

$$r_U = 0.5 \times 10\% + 0.5 \times 6\% = 8\%$$

  - The project's value without leverage is calculated as:

$$V^U = \frac{21}{1.08} + \frac{21}{1.08^2} + \frac{21}{1.08^3} + \frac{21}{1.08^4} = \$69.55 \text{ million}$$

- We now calculate the value of the tax shield provided by interest payments on debt:

	Year	0	1	2	3	4
Project Debt Capacity ($ million)						
1	**Free Cash Flow**	(29.00)	21.00	21.00	21.00	21.00
2	Levered Value, V^L (at $r_{wacc} = 7.25\%$)	70.73	54.86	37.84	19.58	—
3	**Debt Capacity, D_t (at $d = 50\%$)**	**35.37**	**27.43**	**18.92**	**9.79**	**—**

	Year	0	1	2	3	4
Interest Tax Shield ($ million)						
1	**Debt Capacity, D_t (at $d = 50\%$)**	35.37	27.43	18.92	9.79	—
2	Interest Paid (at $r_D = 6\%$)		2.12	1.65	1.14	0.59
3	**Interest Tax Shield (at $\tau_c = 25\%$)**		**0.53**	**0.41**	**0.28**	**0.15**

- This is where:

$$\text{Interest paid in year } t = r_D \times D_{t-1}$$

- Since the firm maintains a target leverage ratio, its future interest tax shields have similar risk to the project's cash flows, so they should be discounted at the project's unlevered cost of capital.

$$PV(\text{interest tax shield}) = \frac{0.53}{1.08} + \frac{0.41}{1.08^2} + \frac{0.28}{1.08^3} + \frac{0.15}{1.08^4} = \$1.18 \text{ million}$$

- All together:

$$V^L = V^U + PV(\text{interest tax shield}) = 69.55 + 1.18 = \$70.73 \text{ million}$$

$$NPV = \$70.73 \text{ million} - \$29 \text{ million} = \$41.73 \text{ million}$$

Flow-to-Equity

- A valuation method that calculates the FCF available to equity holders, **taking into account all payments to and from debt holders.**
- The cash flows to equity holders are then discounted using the equity cost of capital.
    - **Free Cash Flow to Equity (FCFE)**: The FCF that remains after adjusting for interest payments, debt issuance, and debt repayments.

Summary

- Steps:
    - Determine the FCFE of the investment.
    - Determine the equity cost of capital.
    - Compute the equity value by discounting the FCFE using the equity cost of capital.
- **The Flow-to-Equity method has some benefits:**
    - It may be simpler to use when calculating the value of equity for the entire firm if the firm's capital structure is complex and the market values of other securities in the firm's capital structure are not known.
    - It may be viewed as a more transparent method for discussing a project's benefit to shareholders by emphasizing a project's implication for equity.
- And one disadvantage:
    - One must compute the project's debt capacity to determine the interest and net borrowing before capital budgeting decisions can be made.

Example

	Year	0	1	2	3	4
Incremental Earnings Forecast ($ million)						
1	Sales	—	60.00	60.00	60.00	60.00
2	Cost of Goods Sold	—	(25.00)	(25.00)	(25.00)	(25.00)
3	**Gross Profit**	—	35.00	35.00	35.00	35.00
4	Operating Expenses	(6.67)	(9.00)	(9.00)	(9.00)	(9.00)
5	Depreciation	—	(6.00)	(6.00)	(6.00)	(6.00)
6	**EBIT**	(6.67)	20.00	20.00	20.00	20.00
7	Interest Expense	—	(2.12)	(1.65)	(1.14)	(0.59)
8	**Pretax Income**	(6.67)	17.88	18.35	18.86	19.41
9	Income Tax at 25%	1.67	(4.47)	(4.59)	(4.72)	(4.85)
10	**Net Income**	(5.00)	13.41	13.77	14.15	14.56
Free Cash Flow to Equity						
11	Plus: Depreciation	—	6.00	6.00	6.00	6.00
12	Less: Capital Expenditures	(24.00)	—	—	—	—
13	Less: Increases in NWC	—	—	—	—	—
14	Plus: Net Borrowing	35.37	(7.94)	(8.51)	(9.13)	(9.79)
15	**Free Cash Flow to Equity**	**6.37**	**11.47**	**11.25**	**11.02**	**10.77**

	Year	0	1	2	3	4
Free Cash Flow to Equity ($ million)						
1	**Free Cash Flow**	(29.00)	21.00	21.00	21.00	21.00
2	After-tax Interest Expense	—	(1.59)	(1.23)	(0.85)	(0.44)
3	Net Borrowing	35.37	(7.94)	(8.51)	(9.13)	(9.79)
4	**Free Cash Flow to Equity**	**6.37**	**11.47**	**11.25**	**11.02**	**10.77**

- Note that Net Borrowing is the decrease in Debt Capacity. After-tax Interest Expense is the Interest Paid at 25% tax.

	Year	0	1	2	3	4
Interest Tax Shield ($ million)						
1	**Debt Capacity, D_t (at d = 50%)**	35.37	27.43	18.92	9.79	—
2	Interest Paid (at r_D = 6%)		2.12	1.65	1.14	0.59
3	**Interest Tax Shield (at τ_c = 25%)**		**0.53**	**0.41**	**0.28**	**0.15**

- Note that:

$$FCFE = FCF - \underbrace{(1-\tau_c)\times(\text{Interest Payments})}_{\text{After-tax interest expense}} + (\text{Net Borrowing})$$

- Because the FCFE represent payments to equity holders, they should be discounted at the project's equity cost of capital.

$$NPV(FCFE) = 6.37 + \frac{11.47}{1.10} + \frac{11.25}{1.10^2} + \frac{11.02}{1.10^3} + \frac{10.77}{1.10^4} = \$41.73 \text{ million}$$

- This represents the gain to shareholders from the project.

Project Leverage and the Cost of Capital

- If a project uses a target leverage ratio that is different than the firm's, the project r_E may differ from the firm's r_E .

$$r_E = r_U + \frac{D}{E}(r_U - r_D)$$

- Assume equal mix of debt and equity as it expands into plastics.
    - Borrowing costs to be 6%, unlevered cost of capital estimate of 9.5% (as opposed to the firm's 8%).
- The plastic division's equity cost of capital is, and the division's WACC is:

$$r_E = 9.5\% + \frac{0.50}{0.50}(9.5\% - 6\%) = 13.0\%$$

$$r_{wacc} = 0.50 \times 13.0\% + 0.50 \times 6.0\% \times (1 - 0.25) = 8.75\%$$

Comparison of Methods

- WACC method easiest when firm will **maintain fixed debt-to-value ratio** over life of investment.
- For **alternative leverage policies**, APV method simplest approach.
- FTE method used in **complicated settings** where values in firm's capital structure or interest tax shield difficult to determine.

Valuing Businesses

- We move on from valuing projects to entire firms e.g. for takeovers, IPOs, sale of divisions.
    - **Use WACC** to value company financed by mixture of debt and equity.
    - **Debt ratio** is expected to remain **approximately constant**.
    - Treat company as if it were one big project.
- Forecast company's cash flows, discount to present value, remembering:
    - If discount at WACC, cash flows have to be projected just as you would for a capital investment project. Do not deduct interest. **Calculate taxes as if company were all-equity-financed.**
    - Unlike most projects, companies are potentially immortal. Financial managers usually forecast to a medium-term horizon and add a terminal value to cash flows in horizon year.
        - **Terminal value** is present value at horizon of all subsequent cash flows. Estimating terminal value requires careful attention because it often accounts for majority of company's value.
    - Discounting at WACC values assets and operations of company. **If objective is to value company's equity, that is, its common stock, don't forget to subtract value of company's outstanding debt.**

Therefore

- Value of a business or project is usually computed as discounted value of FCF out to valuation horizon (H).
  - Valuation horizon is sometimes called terminal value.
  - r is equal to the WACC.

$$\text{PV} = \underbrace{\frac{\text{FCF}_1}{(1+r)^1} + \frac{\text{FCF}_2}{(1+r)^2} + \ldots + \frac{\text{FCF}_H}{(1+r)^H}}_{\text{PV (free cash flow)}} + \underbrace{\frac{\text{PV}_H}{(1+r)^H}}_{\text{PV (horizon value)}}$$

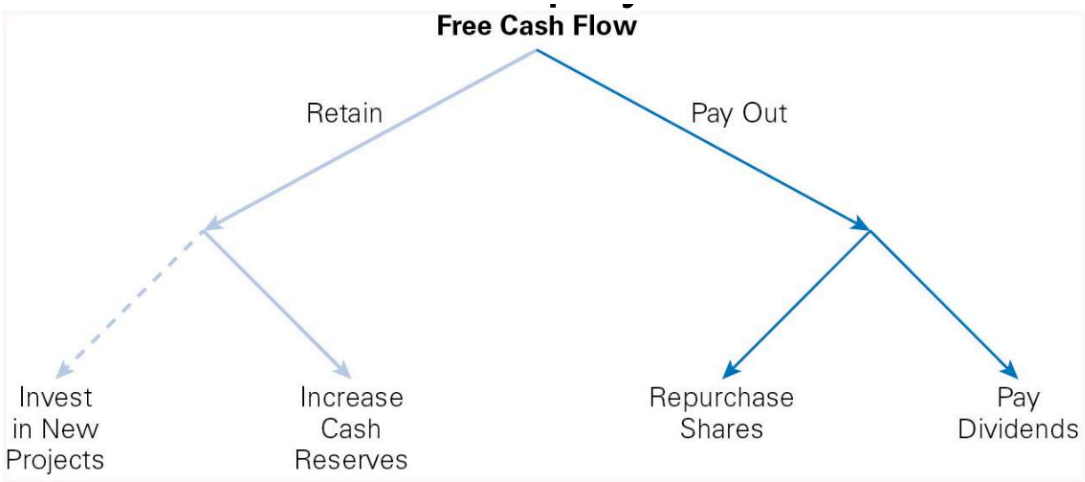
Percent of Sales Method

- Financial forecasting model in which all of a business's accounts (financial line items) like COGS, inventory, and cash are calculated as a percentage of sales.
- These percentages are then applied to future sale estimates to project each line item's FV.

Steps

1. Determine estimated growth and most recent annual sales figures.
2. Determine line item balances and their percentages relative to sales.
3. Calculate forecasted sales.
4. Apply line items' relative percentages to your forecasted sales figure.

Lecture 11 - Payout Policy



- The way a firm chooses between the alternative ways to distribute FCF to equity holders.

    - **Special Dividend:** a one-time dividend payment a firm makes, which is usually much larger than a regular dividend.
    - **Stock Split (Stock Dividend)**: when a company issues a dividend in shares of stock rather than cash to its shareholders.
- **Share Repurchases**:
    - An alternative way to pay cash to investors is through a share repurchase or buyback i.e. firm uses cash to buy shares of its own outstanding stock.
    - **Open Market Repurchase**: repurchases shares by buying shares in the open market (represents 95% of repurchase transactions).
    - **Tender Offer**: public announcement of an offer to all existing security holders to buy back a specified amount of outstanding securities at a prespecificied price (usually 10% to 20% premium) over a specified period of time (20 days).
        - If shareholders do not tender enough shares, the firm may cancel and no buyback occurs.

Terminology

- **Declaration Date:** the date on which the board of directors authorizes the payment of a dividend.
- **Ex-dividend Date**: a date, two days prior to a dividend's record date, on or after which anyone buying the stock will not be eligible for the dividend.
    - **Cum-Dividend**: If a stock is traded BEFORE this date, the buyer is entitled to the dividend.
- **Record Date**: when a firm pays a dividend, only shareholders on record on this date receive the dividend.
- **Payable Date (Distribution Date)**: a date, generally within a month after the record date, on which a firm mails dividend checks to its registered stockholders.

Comparison of Dividends and Share Repurchases

Dividend Payment

- $20 million excess cash to be paid as a $2 dividend immediately to 10 million outstanding shares.
- No debt, $r_E = r_U = 12\%$, and future FCF of $48 million per year, anticipating $4.80 dividend per share each year thereafter.

	December 11 (Cum-Dividend)	December 12 (Ex-Dividend)
Cash	20	0
Other assets	400	400
Total market value	420	400
Shares (millions)	10	10
share price	**$42**	**$40**

Cum-dividend Price

$$P_{cum} = \text{Current Dividend} + PV(\text{Future Dividends}) = 2 + \frac{4.80}{0.12} = 2 + 40 = \$42$$

After Ex-Dividend Date

$$P_{ex} = PV(\text{Future Dividends}) = \frac{4.80}{0.12} = \$40.$$

- In a **perfect capital market**, when a dividend is paid, the **share price drops by the amount of the dividend** when the stock begins to trade ex-dividend.

Share Repurchase

- With initial share price of $42, Genron is able to repurchase $20 million / $42 = 0.476 million shares.
  - This leaves 9.524 million shares outstanding.
- The **net effect on the share price remains unchanged**.

	December 11 (Before Repurchase)	December 12 (After Repurchase)
1. Cash	20	0
2. Other assets	400	400
1.+ 2.= 3.Total market value of assets	420	400
4. Shares (millions)	10	9.524
3. / 4. = 5. share price	$**42**	$**42**

Genron's Future Dividends

- The **purchase has no effect on the stock price**, seeing as the future dividends rise to balance the loss in total market value of assets ($20 million).
  - This price is the same as the cum-dividend price if a dividend was instead paid.

$$\frac{48 \text{ million}}{9.524 \text{ million shares}} = \$5.04 \text{ per share.}$$

Genron's share price is

$$P_{rep} = \frac{5.04}{0.12} = \$42.$$

Investor Preferences

- In perfect capital markets, investors are indifferent between the firm distributing funds via dividends or share repurchases.
- By reinvesting dividends or selling shares, they can replicate either payout method on their own.
- In the case of Genron, if the firm repurchases shares and the investor wants cash, the investor can raise cash by selling shares.
  - This is called a **homemade dividend**.

- If the firm pays a dividend and the investor would prefer stock, they can use the dividend to purchase additional shares.

Dividend with Share Sale

- Genron wants to pay a $4.80 dividend per share right now ($48 million total), but only $20 million in cash today.
  - To make up for the $28 million, the firm sells 28 million / 42 per share = 0.67 million shares.
- The new dividend per share will be:

$$\frac{\$\ 48\ \text{million}}{10.67\ \text{million shares}} = \$4.50\ \text{per share}$$

- The cum-dividend share price will be:

$$P_{cum} = 4.50 + \frac{4.50}{0.12} = 4.50 + 37.50 = \$42.$$

- The share price is unchanged.

Dividend Policy Irrelevance

- There is a **tradeoff between current and future dividends**.
  - Higher current dividend = Low future dividends, and vice versa.

	Initial Share Price	Dividend Paid ($ per share)			
		Year 0	Year 1	Year 2	. . .
Policy 1:	$42.00	2.00	4.80	4.80	. . .
Policy 2:	$42.00	0	5.04	5.04	. . .
Policy 3:	$42.00	4.50	4.50	4.50	. . .

- In perfect capital markets, holding fixed the investment policy of a firm, the **firm's choice of dividend policy is irrelevant and does not affect the initial share price**.
- A firm's free cash flow determines the level of payouts that it can make to its investors.
  - In a perfect capital market, the type of payout is irrelevant.
  - In reality, capital markets are not perfect, and it is these imperfections that should determine the firm's payout policy.

Tax Disadvantage of Dividends

- Shareholders must pay taxes on the dividends they receive, and they must also pay capital gains taxes when they sell their shares.
- **Dividends are typically taxed at a higher rate than capital gains**. In fact, long-term investors can defer the capital gains tax forever by not selling.
- The higher tax rate on **dividends** makes it **undesirable** for a firm to raise funds to pay a dividend.

    - When dividends are taxed at a higher rate than capital gains, if a firm raises money by issuing shares and then gives that money back to shareholders as a dividend, shareholders are hurt because they will receive less than their initial investment.
- In Australia Capital gains are discounted by 50% if held for longer than a year, then taxed at the marginal personal tax rate.
- When the **tax rate on dividends is greater than the tax rate on capital gains**, shareholders will pay lower taxes if a firm uses share repurchases rather than dividends.
    - This tax savings will increase the value of a firm that uses **share repurchases rather than dividends**.
- The optimal dividend policy when the dividend tax rate exceeds the capital gain tax rate is to pay no dividends at all.
    - The payment of dividends has declined on average over the last 30 years while the use of repurchases has increased.
- **Dividend Puzzle**: when firms continue to issue dividends despite their tax disadvantage.

Clienteles

- The preference for share repurchases rather than dividends depends on the difference between the dividend tax rate and the capital gains tax rate.
    - Tax rates vary by income, by jurisdiction, and by whether the stock is held in a retirement account.
    - Given these differences, firms may attract different groups of investors depending on their dividend policy.
        - Income Level
        - Investment Horizon
        - Tax Jurisdiction
        - Type of Investor or Investment Account

Investor Group	Dividend Policy Preference	Proportion of Investors
Individual investors	Tax disadvantage for dividends generally prefer share repurchase(except for retirement accounts)	~52%
Institutions, pension funds	No tax preference prefer dividend policy that matches income needs	~47%
Corporations	Tax advantage for dividends in US	~1%

- **Clientele Effect**: when dividend policy of firm reflects tax preference of its investor clientele.
    - Individuals in highest tax brackets have preference for stocks that pay no or low dividends, whereas tax-free investors and corporations have preference for stocks with high dividends.
- **Dividend-Capture Theory**: Given absent transaction costs, investors can trade shares at time of dividend so that non-taxed investors receive dividend.
    - Should see large trading volume around ex-dividend day, as high-tax investors sell and low-tax investors buy stock in anticipation of dividend, and then reverse those trades just after ex-dividend date.

Retaining Cash

- If a firm has already taken all positive-NPV projects, any additional projects it takes on are zero or negative-NPV investments.
    - Rather than waste excess cash on negative-NPV projects, firm can use cash to purchase financial assets.
    - In perfect capital markets, **buying and selling securities is a zero-NPV transaction**, so it should not affect firm value.
- Thus, with perfect capital markets, retention versus payout decision is irrelevant.
- **MM Payout Irrelevance**: In perfect capital markets, if firm invests excess cash flows in financial securities, the firm's choice of **payout versus retention is irrelevant** and does not affect the initial share price.
- Corporate taxes make it costly for firm to retain excess cash.
    - Cash is equivalent to negative leverage, so the tax advantage of leverage implies a tax disadvantage to holding cash.

Adjusting for Investor Taxes

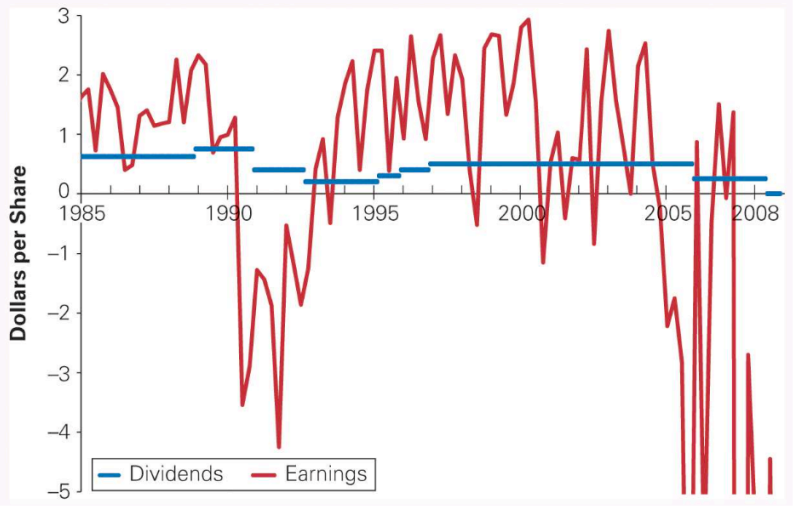
- The decision to pay out versus retain cash may also affect the taxes paid by shareholders.
    - When firm retains cash, it must pay corporate tax on interest it earns.
    - In addition, investor will owe capital gains tax on increased value of firm.
    - **In essence, interest on retained cash is taxed twice.**
    - If the firm paid cash to its shareholders instead, they could invest it and be taxed only once on the interest that they earn.

Issuance and Distress Costs

- Generally, **firms retain cash balances to cover potential future cash shortfalls**, despite tax disadvantage to retain cash.
    - A firm might accumulate a large cash balance if there is reasonable chance that future earnings will be insufficient to fund future positive-NPV investment opportunities.
- Cost of holding cash to cover future potential cash needs should be **compared to increase** in transaction, agency, and adverse selection costs of raising new capital through new debt or equity issues.
    - Excessive cash may be used by managers inefficiently, by paying excessive executive perks, over-paying for acquisitions.
    - Paying out excess cash through dividends or share repurchases, rather than retaining cash, can boost the stock price by reducing managers' ability and temptation to waste resources.

Signalling with Payout Policy

- **Dividend Smoothing**: the practice of maintaining relatively constant dividends.
    - Firms change dividends infrequently, and dividends are much less volatile than earnings.



- Research has found that:
  - Management believes investors prefer stable dividends with sustained growth.
  - Management maintain long-term target level of dividends as fraction of earnings.
  - Thus, firms raise dividends only when they perceive long-term sustainable increase in expected level of future earnings and cut them only as last resort.
- **Dividend Signaling Hypothesis**: dividend changes reflect managers' views about firm's future earning prospects
  - If firms smooth dividends, firm's dividend choice will contain information regarding management's expectations of future earnings.
  - **When firm increases dividend,** sends positive signal to investors that management expects to afford higher dividend for foreseeable future.
  - **When firm decreases dividend,** signal that management has given up hope that earnings will rebound in near term and need to reduce dividend to save cash.
- Although **increase of firm's dividend** may signal management's optimism regarding future cash flows, it may **signal a lack of investment opportunities.**
- Conversely, a **firm might cut dividend to exploit new positive-NPV investment opportunities**. In this case, dividend decrease might lead to positive rather than negative stock price reaction.

Signaling and Share Repurchases

- **Share repurchases** a credible signal that **shares are underpriced**, because if they are overpriced share repurchase is costly for current shareholders.
  - If investors believe that managers have better information regarding firm's prospects and act on behalf of current shareholders, then investors will react favorably to share repurchase announcements.

Stock Dividends and Splits

- With stock dividend, firm does not pay out any cash to shareholders.
  - Total market value of firm's equity unchanged.
  - Only number of shares outstanding different (increase).
  - **Stock price falls because total equity value divided over larger number of shares.**

Example

- Genron pays a 50% stock dividend (3:2 stock split) rather than a cash dividend.
- Shareholder who owns 100 shares at $42/share before dividend has a portfolio worth $4,200.
- After the dividend, they own 150 shares with the same portfolio worth.

$$\text{Share Price} = \frac{4200}{150} = \$28$$

- Stock dividends are not taxed, so from both firm's and shareholder's perspectives, there is no real consequence.

	December 11 (Cum-Dividend)	December 12 (Ex-dividend)
Cash	20	20
Other assets	400	400
Total market value of assets	420	420
Shares (millions)	10	15
Share Price	**$42**	**$28**

- Stock splits keep share price in a range attractive to small investors.
  - If share price rises “too high”, difficult for small investors to invest in stock.
  - Keeping price “low” make stock more attractive to small investors and can increase demand for and liquidity of stock (may boost stock price).
- On average, announcements of stock splits are associated with 2% increase in stock price.
- **Reverse Split**: When price of company’s stock falls too low and company reduces number of outstanding shares

Lecture 12 - Agency Problems, Performance Measurement and Signalling

Agency Problems To Watch Out For

- **Reduced Effort**
  - Finding & implementing investment in truly valuable projects is a high-effort, high-pressure activity.
  - Financial manager tempted to **slack off**.
- **Perks**
  - Our hypothetical financial manager gets no bonuses only $X per month.

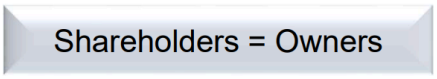
    - But may take bonus not in cash, but in tickets to sporting events, lavish office accommodations, planning meetings scheduled at luxury resorts…
    - Economists refer to these non-pecuniary rewards as private benefits (perks = perquisites).
    - The issue is that they have **diminishing returns**.
- **Avoiding Risk**
    - Manager with only fixed salary cannot share in upside of risky projects.
    - But, if risky project turns out to be loser, job may be on the line.
    - In this case safe projects are from manager's viewpoint better than risky ones, despite them having large, positive NPVs.
- **Empire Building**
    - Managers prefer to run **large businesses rather than small ones**. Getting from small to large may not be a positive-NPV undertaking.
    - Managers reluctant to dismantle their empires (disinvest).
- **Entrenching Investment**
    - Projects designed to require or reward skills of existing managers.
    - Suppose manager Q considers two expansion plans.
    - One plan require manager with **special skills** that manager Q happens to have.
    - Other plan requires only general-purpose manager.
    - Which plan Q will favour?

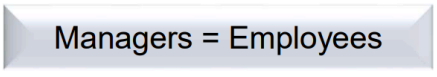
Free Cash Flow Problem

- Entrenching investments & empire building are symptoms of **overinvestment** (investing beyond the point where NPV falls to zero).
- Temptation to overinvest highest when firm has plenty of cash but limited investment opportunities.

Principal Agent Problem

- Managers cannot be perfect agents of their shareholders.
- **Managers have own interests and concerns.**
    - They may not find and invest in all and only positive-NPV investments.
    - Agency costs and information asymmetries are incurred when they don't.





Question: Who has the power?

Answer: Managers

Agency Problems at the Top

- Too many projects for top management to analyze.
- Details are beyond the view of execs.
- Many decisions are not in the capital budget and small decisions add up.
- Execs are also subject to human error.

Excessive Risk Taking

- Managers must take some risks along the way.
- Managers compensated with stock options have incentive to take risk.
- Gambling for redemption.
- Organizations hesitate to curtail successful risky activities.

Ways to Reduce Agency Costs

Monitoring

- Agency costs can be reduced by monitoring manager's efforts and actions and by intervening when manager veers off course.
- Monitoring can prevent more obvious agency costs, such as blatant perks. It can confirm that manager is putting sufficient time on the job.
- BUT monitoring requires time and money (agency cost).
    - Some monitoring is almost always worthwhile, but a limit is soon reached at which an extra dollar spent on monitoring would not return an extra dollar of value from reduced agency costs.
    - Like all investments, **monitoring encounters diminishing returns.**

Assymetric Information Creates Unmonitorable Agency Costs

- Some agency costs can't be prevented even with the most thorough monitoring.
- Suppose shareholder undertakes to monitor capital investment decisions.
- How could she ever know for sure whether capital budget approved by top management includes:
    1. All the positive-NPV opportunities open to the firm
    2. No projects with negative NPVs due to empire-building or entrenching investments?
- The managers obviously know more about the firm's prospects than outsiders ever can.
    - If shareholder could list all projects and their NPVs, then managers would not be needed.

Board of Directors

- In large, public companies, the **task of monitoring is delegated to board of directors**, who are **elected by shareholders** to represent their interests.
- Boards of directors sometimes portrayed as passive stooges who always champion the incumbent management.
    - But response to past corporate scandals has tipped the balance toward greater independence.
    - In large companies, 85% of all directors are now independent.
- When managers are not up to the job, boards frequently step in. In recent years, the CEOs of Ford, CSX, AIG, and Wells Fargo have all been replaced.
- Boards outside the United States, which traditionally have been more management friendly, have also become more willing to replace underperforming managers.
- Delegation of monitoring to the board **brings its own agency problems**.
    - For example, many board members may be friends of the CEO and may be indebted to the CEO for help or advice.

    - They may be reluctant to fire the CEO or enquire too deeply into his or her conduct.

Auditors

- Board required to hire independent accountants to audit firm's financial statements.
- If audit uncovers no problems, auditors issue an opinion that financial statements fairly represent company's financial condition and consistent with accounting standards.

Lenders

- When company takes out large bank loan, bank tracks company's assets, earnings, and cash flow. By monitoring to protect its loan, bank generally protects shareholders' interests also.

Shareholders

- Shareholders keep an eye on company's management and board of directors.
    - If they think that a corporation is not pursuing shareholder value with sufficient energy and determination, they can try to force change; for example, by nominating candidates to board of directors.
- **Activist investors** specialize in finding underperforming companies and trying to convince them to restructure.
    - Company's shareholders appear to welcome arrival of an activist investor, announcement of acquisition of 5% holding by activist prompts 7% to 8% abnormal return on stock.
- **Smaller shareholders** can't play the activist investors' game, but they can take the "Wall Street Walk" by selling out and moving on to other investments.
    - **The Wall Street Walk** can send a powerful message. If enough shareholders bail out, the stock price tumbles. This damages top management's reputation and compensation.

Takeovers

- A company's management is regularly monitored by other management teams.
- If latter believe that assets are not being used efficiently, then they can try to take over business and boot out existing management.

Management Compensation

- Compensation plans designed to attract competent managers and **give them right incentives.**
- If shareholders want management to act in their best interest, make the managers shareholders.
    - Including ability to acquire shares as part of management compensation can align incentives.
- Attempt to ensure compensation is:
    - **Reasonable**
    - **Linked to Performance**
- Determine compensation using independent compensation committees, noting that **compensation tends to creep up**.

Structure

- **Compensation structure more important than amount.**
  - Compensation package should encourage managers to maximize shareholder wealth.
- Compensation could be based on input (for example, the manager's effort) or on output (income or value added as a result of manager's decisions).
  - Because effort not observable, **compensation must be based on output, on verifiable results.**
- Results depend not just on manager's contribution, but also on events outside manager's control. Unless you can separate out manager's contribution, you face a difficult trade-off.
  - Give manager **high-powered incentives by tying compensation to firm value**. Suppose firm is cyclical business that always struggles in recessions. Then high-powered incentives will force manager to bear business cycle risk that is not her fault.

Link to Firm Value

- Most major companies link part of executive pay to performance of companies' stock.
- **Stock options give managers right (but not obligation) to buy their company's shares in the future at a fixed exercise price.**
  - Exercise price set equal to company's stock price on day options are granted.
  - **If stock price increases**, manager exercises options and cash in on difference between stock price and exercise price.
  - **If stock price falls,** manager leaves options unexercised and hopes for compensation through another channel.
- **Restricted shares:** manager receives shares at end of vesting period as long as still with company.
  - Or with **performance shares**: manager receives shares related to performance in interim.

Side Effects

- Compensation based on stock price forces managers to bear risks outside their control.
  - Some companies take out effect of luck by measuring and rewarding performance relative to industry peers.
- Stock options can encourage excessive risk taking.
- Managers tempted to withhold bad news or manage reported earnings.
- Managers tempted to postpone or cancel valuable investment projects if projects would depress earnings in short run.

Residual Income or Economic Value Added (EVA)

- Techniques for overcoming errors in accounting measurements of performance.
  - **Emphasizes NPV concepts** in performance evaluation over accounting standards.
- Looks more to long-term than short-term decisions.
- More closely tracks shareholder value than accounting measurements.

Residual income or EVA = net dollar return after deducting the cost of capital

$$\begin{aligned}\text{EVA} &= \text{residual income} \\ &= \text{income earned} - \text{income required} \\ &= \text{income earned} - \left[\text{cost of capital} \times \text{investment}\right]\end{aligned}$$

FURTHERMORE

$$\text{EP} = \text{economic profit} = (\text{ROI} \times \text{r}) \times \text{capital invested}$$

Pros and Cons of EVA

Positives

- Managers are motivated to only invest in projects that earn more than they cost.
- EVA makes cost of capital visible to managers.
- Leads to a reduction in assets employed.

Negatives

- Unclear whether EVA consequence of bad management or other factors.
- Data on which it is based $\rightarrow$ Ignores the fact that no long-term benefit accrues from a project, which makes it bad.

Measures of Performance

Accounting

$$\begin{aligned}\text{Rate of return} &= \frac{\text{cash receipts} + \text{change in price}}{\text{beginning price}} \\ &= \frac{C_1 + (P_1 - P_0)}{P_0}\end{aligned}$$

Economic

$$\text{Rate of return} = \frac{C_1 + (\text{PV}_1 - \text{PV}_0)}{\text{PV}_0}$$

Summary and Example

	ECONOMIC	ACCOUNTING
INCOME	Cash flow + change in PV = Cash flow - economic depreciation	Cash flow + change in book value = Cash flow - accounting depreciation
RETURN	**Economic Income** PV at start of year	**Accounting Income** BV at start of year

Comparing Book Income, ROI, EVA vs Economic Income, Rate of Return, EVA

Cost of capital = 10%
Book depreciation = 1000 / 6 = 167
Book value end of year = book value start of year - depreciation
Book income = Cash flow - depreciation
Book ROI = Book income / Book value start of year
EVA = Book income - 10% x Book value start of year

	Year					
	1	2	3	4	5	6
Cash flow	100	200	250	298	298	297
Book value at start of year	1,000	834	667	500	333	167
Book value at end of year	834	667	500	333	167	0
Book depreciation	167	167	167	167	167	167
Book income	−67	33	83	131	131	130
Book ROI	−0.067	0.040	0.125	0.263	0.394	0.782
EVA	−167	−50	17	81	98	114

- Note: If book rate of return is the same in each year of a project's life, the book rate of return equals the IRR.
- Where:

$$\text{PV End} = \text{PV Start} * \text{Cost of Capital} - \text{Cash Flow}$$

$$\text{Economic Income} = \text{Cash Flow} - \text{Economic Depreciation}$$

$$\text{EVA} = \text{Economic Income} - \text{Cost of Capital} * \text{PV Start}$$

	Year					
	1	2	3	4	5	6
Cash flow	100	200	250	298	298	297
PV at start of year	1,000	1,000	900	740	516	270
PV at end of year	1,000	900	740	516	270	0
Economic depreciation	0	100	160	224	246	270
Economic income	100	100	90	74	52	27
Rate of return	0.10	0.10	0.10	0.10	0.10	0.10
EVA	0.00	0.00	0.00	0.00	0.00	0.00