Investment and Financial Management Lecture Notes

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1 Introduction & Financial Analysis

Corporate Finance: Identifying profitable investment projects + Determining optimal financing + Liquidity planning => <u>Maximizing firm / enterprise value</u>

2 Financial Analysis

2.1 Firms's disclosure of financial information

Purpose of financial statements:

1. Firm-issued accounting reports with past performance info

2. Reliable source of info for shareholders and stakeholders[1] of the firm

3. Filed with relevant listing authority

4. Preperation under certain rules and standards (GAAP, IFRS)

Main types of financial statements:

1. Balance sheet / statement of financial position

2. Income Statement

3. Statement of cash flows

4. Statement of changes in shareholders' equity

2.2 Balance sheet / statement of financial position

Balance sheet / financial position: snapshot of firm's financial position (assets, liabilities, shareholder's equity) at a given point in time

Balance sheet equation: Two sides must be equal: <u>*Assests = Liabilities + Shareholder's Equity*</u>

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[1]A **shareholder** is someone who owns stock in your company, while a **stakeholder** *(example: supplier, government)* <u>focuses on the company's overall performance</u>, how it treats customers, partners, and employees, and how it impacts the community, among other things.

Balance Sheet					
Assets			**Liabilities**		
Current Assets <12 months	Cash & Equivalents	Cash, T-Bills <3 Month Maturity	**Current Liabilities**	Short-Term Debt	Debt that is due <1 Year
	Marketable Securities	Equity, Debt (Liquid Financial Instruments)		Payables	Interest, Wages, Dividends, Taxes, Accrued Liabilities
	Accounts Receivable	Outstanding Payments by customers	**Long-Term Liabilities**	Long-Term Debt	Interest & Principal on Bonds >1 Year
	Inventory	Produced Goods ready for sale		Deferred Taxes	Taxes due >1 Year
	Prepaid Expenses	Rent, Insurance Advanced Payments		Pension Liabilities	Employee Retirement
Long-Term Assets	Long Term Investments	Illiquid Securities <1 Year	**Shareholder Equity**	Retained Earnings	Profits kept by the Company
	Fixed Assets	Land, Mashinery, Equipment, Buildings		Treasury Stock	Repurchased Stock
	Intangible Assets	Brandname, Goodwill Patents, Trademarks		Additional Paid-In Capital	Shareholder Investments beyond par value price

The Accounting Equation

Assets = Liabilities + Shareholder's Equity

- **Assets:** what the company owns

- **Liabilities:** what the company owes (debts, taxes etc.)

- **Shareholder's Equity:** difference between assets and liabilities

- **Assets**

  - **Current Assests:** cash or expected to be turned into cash in the next year (not all operational!) *(cash, marketable securities, accounts receivable, inventories)*

  - **Non-current Assets (Fixed assets):** assets for long-term use (operational, more than one year) *(net property, plant, equipment(PPE), goodwill and intangible assets)*

- **Liabilities**

  - **Current Liabilities:** due to be paid within one year *(accounts payable, short-term debt / notes payable, current maturities of non-current (long term) debt, taxes payable, wages payable)*

  - **Net working capital (NWC):**

$$\boxed{NWC = Current\ Assets - Current\ Liabilities}$$

  - **Non-current Liabilities:** to be paid beyond one year *(long-term debt, capital leases, deferred taxes)*

- **Shareholder's Equity: Book value vs. Market value**[2]

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[2]**Book value** is the <u>net value of a firm's assets</u> found on its balance sheet. **Market value** is the <u>company's worth</u> based on the total value of its outstanding shares in the market, which is its market capitalization.

– **Book value of equity:**

$$Book\ value\ of\ equity = Book\ value\ of\ assets - Book\ value\ of\ liabilities$$

* Could be negative
* Many of the valuable assets may not be captured on the balance sheet

– **Market value of equity (= Market capitalization, market cap):**

$$Market\ value\ of\ equity = Market\ price\ per\ share * No.\ of\ shares\ outstanding$$

* Cannot be negative
* Often differs substantially from book value

– **Market-to-book (M/B) ratio (= Price-to-book (P/B) ratio):**

$$M/B\ ratio = \frac{Market\ value\ of\ equity}{Book\ value\ of\ equity}$$

* Successful firms have M/B ratio higher than 1
* Value Stocks[3]: Low M/B ratios
* Growth stocks[4]: High M/B ratios

- **Enterprise value (EV) (= Total enterprise value (TEV))**

  – Value of firm's underlying business operations / assets
  – Enterprise value $\neq$ Equity value

$$Enterprise\ value = Market\ value\ of\ equity + \underbrace{Debt - Cash}_{Net\ debt}$$

  * $Net\ debt = Total\ debt - Cash\ \&\ short\text{-}term\ investments$

  subs

2.3   Income statement

Income statement: record of a firm's revenue, expense, and profit over a given period of time

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[3]A **value stock** is trading at levels that are perceived to be below its fundamentals.

[4]A **growth stock** is any share in a company that is anticipated to grow at a rate significantly above the average growth for the market *(example: TSLA)*.

Income statement of firm XY
Revenue / total sales
− Cost of sales / cost of goods sold (COGS)
= Gross profit

− Operating expenses:
  • Selling, general and administrative expenses (SGA)
  • Depreciation and amortization expense (D&A)

= Operating income
+ / − Other income / expenses
= Earnings before interest and taxes (EBIT)
+ / − Interest income / expenses
= Pre-tax income
− Tax
= Net income

- **Net Income = Total earnings of the firm's equity holders**

  - **Earnings per share (EPS):** how much money a company makes for each share of its stock

$$EPS = \frac{Net\ income}{Shares\ outstanding}$$

  - **Diluted earnings per share (Diluted EPS):**[5] Future EPS could be diluted by in-the-money share (stock) options, convertible bonds or warrants. The diluted EPS takes these potential effects intp account.

2.4 Statement of cash flows

- Record of sources and uses of the firm's cash over a given period of time

  - Sources of cash: activity that brings cash into firm *(example: sales)*
  - Uses of cash: causes cash to leave firm *(example: dividend payments[6])*

- Derived from firm's income statement and changes in balance sheet

- Consists of:

  - Cash flows from **operating**, **investing** and **financing** activities

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[5]**Dilution** occurs when a company <u>issues new shares</u> that result in <u>a decrease in existing stockholders' ownership percentage</u> of that company.

[6]A **dividend** is the <u>distribution of a company's earnings to its shareholders</u> and is determined by the company's board of directors.

2.5 Financial statement analysis

- **Financial ratios**

    - Are used to:
        * Compare firm with itself over time
        * Compare firm to other similar firms
    - Key financial ratios measure a firm's:
        * Profitability
        * Liquidity
        * Working Capital
        * Interest Covarage
        * Leverage (Gearing)
        * Valuation
        * Operating Returns

- **Profitability ratios**

    - Measures of a firm's ability to generate profits as a percentage of the sales generated (margin ratios; margin = portion of sales that is a profit)
    - Four levels of profitability ratios (resulting from income statement)

        1.
        $$Gross\ margin = \frac{Gross\ profit}{Sales}$$

        2.
        $$Operating\ margin = \frac{Operating\ income}{Sales}$$

        3.
        $$EBIT\ margin = \frac{EBIT}{Sales}$$

        4.
        $$Net\ profit\ margin = \frac{Net\ income}{Sales}$$

- **Liquidity ratios**

    - Measures of a firm's ability to meet short-term debt obligations
    - Help to assess firm's liquidity / financial solvency info of balance sheet / statement of financial position

1.

$$Current\ ratio = \frac{Current\ assets}{Current\ liabilities}$$

2.

$$Quick\ ratio = \frac{Cash + Short\text{-}term\ investm. + Accounts\ receivables}{Current\ liabilities}$$

3.

$$Cash\ ratio = \frac{Cash}{Current\ liabilities}$$

- **Interest coverage ratios**

  - Measures of a firm's ability to meet its interest payments by comparing its earnings with its interest expenses
  - Higher ratio = firm is earning much more than necessary to meet its obligations

  1.

  $$EBIT/Interest\ coverage = \frac{EBIT}{Interest\ expense}$$

  2.

  $$EBITDA/Interest\ coverage = \frac{\overbrace{EBITDA}^{\text{EBIT + Depreciation/Amortization[7]}}}{Interest\ expense}$$

- **Leverage / gearing ratios**

  - Measures of a firm's reliance on debt as a source of financing
  - Leverage ratios can be measured using book or market values!
  - Important and common ratios:

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[7]**Amortization** is the method that is used to <u>decrease the cost of the asset over time</u>, while **depreciation** is the <u>loss in value of the asset over time</u>. Both of them are methods of calculating the value for business assets over time.

1.

$$\text{Debt-equity ratio} = \frac{Total\ debt}{Total\ equity}$$

2.

$$\text{Debt-to-capital ratio} = \frac{Total\ debt}{Total\ equity + Total\ debt}$$

3.

$$\text{Debt-to-EV ratio} = \frac{Net\ debt}{Market\ value + Net\ debt}$$

4.

$$\text{Equity multiplier} = \frac{Total\ assets}{Book\ value\ of\ equity}$$

- **Valuation ratios**

  - Measures to help investors assess market value of a firm
  - These ratios are intended to make intra-industry comparisons of firm valuations.

    1.

    $$\text{Price-to-earnings (P/E) ratio} = \frac{Market\ capitalization}{Net\ income}$$
    $$= \frac{Share\ price}{Earnings\ per\ share}$$

    2.

    $$\text{EV to EBIT} = \frac{Market\ value\ of\ equity + Debt - Cash}{EBIT}$$

    3.

    $$\text{EV to Sales} = \frac{Market\ value\ of\ equity + Debt - Cash}{Sales}$$

- **Operating returns / investment returns**

  - Measures of a firm's returns on investment

– Compare its income to its investment using financial information from balance sheet / statement of financial position

1.

$$Return\ on\ equity\ (ROE) = \frac{Net\ income}{Book\ value\ of\ equity}$$

2.

$$Return\ on\ assets\ (ROA) = \frac{Net\ income + Interest\ expense}{Total\ assets}$$

3.

$$Return\ on\ invested\ capital\ (ROIC) = \frac{EBIT * (1 - Tax\ rate)}{Book\ value\ of\ equity + Net\ debt}$$

4.

$$Asset\ turnover = \frac{Sales}{Total\ assets}$$

- **DuPont identity**

  – DuPont identity further decomposes return on equity (ROE) into theree components:
    * Profitability (= Net profit margin)
    * Asset efficiency (= Asset turnover)
    * Leverage (= Equity multiplier)

$$ROE = (\underbrace{\frac{Net\ income}{Sales}}_{Net\ profit\ margin}) * (\underbrace{\frac{Sales}{Total\ assets}}_{Asset\ turnover}) * (\underbrace{\frac{Total\ assets}{Book\ value\ of\ equity}}_{Equity\ multiplier})$$

3 Investment Analysis

3.1 Net present value (NPV)

- **NPV (of a project or investment):** difference between present value of its benefits (cash inflow) and present value of its costs (cash outflow)

$$NPV = PV(Benefits) - PV(Costs) = PV(All\ project\ cash\ flows)$$

$$NPV = \sum_{t=0}^{T} \frac{CF_t}{(1+r)^t}$$

With:

- NPV = Net present value, PV = Present Value, CF_t = cash flow in period t, r = Appropriate discount rate

- **NPV rule:**

  - **NPV decision rule:** When making an investment decision, take the alternative with the highest NPV.

  - **Accepting or rejecting a project:**

    * Accept, if positive NPV, expected profit => equivalent to receiving its NPV cash today
    * Reject, if negative NPV, expected net loss => would reduce the wealth of investors

  - **Alternative rules versus NPV rule:**

    * Sometimes alternative investment rules give the same answer as the NPV rule, but at other times they disagree. If rules conflict, follow NPV decision rule.
    * Equivalent rules: Economic value added (EVA), Annuity-rule

3.2 Internal rate of return (IRR)

- **IRR:** discount rate that makes NPV equal to zero (at which PV(Costs) = PV(Benefits))

$$NPV = \sum_{t=0}^{N} \frac{CF_T}{(1+IRR)^t} = 0$$

With:

- NPV = Net present value, CF_t = cash flow in period t, IRR = Internal rate of return

- **IRR rule:**

  - **IRR investment rule:**

    * Take any investment, if its IRR exceeds cost of capital[8]

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[8]**Cost of capital** is the minimum rate of return or profit a company must earn before generating value (e.g. undertaking a project, such as building new factory).

* Turn any down investment, if its IRR is less than cost of capital
  – **Application of IRR rule: IRR vs. NPV**
    * IRR rule works for a stand-alone project if all of the project's **negative cash flows**[9] precede **positive cash flows**[10]. In other cases, IRR rule may disagree with NPV rule thus be incorrect!

      Example: If market conditions change over the years, project A can have multiple IRRs. Thus, IRR cannot be used. Instead, use NPV for comparison of projects.
  – **Pitfalls of IRR rule:** Situations where IRR and NPV rules may conflict:
    1. Delayed investments
    2. Multiple IRRs
    3. Nonexistent IRR

- **IRR vs. IRR rule:**
  – While IRR rule has shortcomings for making investment decisions, IRR itself remains useful.
  – **But:**
    * IRR measures average return of investment $=>$ exact measure for average ROIC of a project over its lifetime.
    * IRR can be used to check the sensitivity of NPV to any estimation error in the cost capital.

- **Mutually exclusive projects:**
  – When you must choose only one project among several possible projects, the choice is mutually exclusive[11].
    * **NPV rule:** Select the project with highest NPV.
    * **IRR rule:** Selecting the project with the highest IRR may lead to mistakes.

- **IRR rule and mutually exclusive investment with project ranking with different scales:**
  – If a project's size is doubled, its NPV will double. This is not the case with IRR. Thus, IRR rule cannot be used to compare projects of different scales.

- **Project ranking with timing of cash flows:**

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[9]outgoing $>$ incoming
[10]outgoing $<$ incoming
[11]If two or more events are **mutually exclusive**, they cannot happen simultaneously.

– Problem with IRR: it can be affected by changing the timing of cash flows, even when the scale is the same.
– IRR is a return, but the dollar value of earning a given return depends on how long the return is earned.
– *Example: A project with lower IRR can have a much higher NPV due to its higher growth rate.*

- **Project ranking with differences in risk:**

  – An IRR, that is attractive for a safe project, need not to be attractive for a riskier project.
  – *Example: IRR of a project is higher than those of the other investment opportunities, yet has the lowest NPV.*
  – Higher cost of capital (e.g. due to size of the project) = Higher IRR

3.3   Other methods

- **Payback method:**

  – **Payback period:** amount of time it takes to recover or pay back the initial investment (initial cash outflow).
  – **Payback rule:** Accept project, if payback period is less than a pre-specified length of time. Otherwise reject.
  – **Applicability of payback rule:** Payback rule is used by many companies due to its simplicity. Maybe, firms often care more about the liquidity drain of a project rather than its profitibility.
  – **Shortcomings of the payback rule:**
    * Ignores the project's cost of capital and time value of money [12]
    * Ignores cash flows after the payback period
    * Relies on an ad hoc decision criterion

- **Probability index (PI):** PI can be used to identify the optimal combination of projects to undertake. Companies use it for evaluation of projects with different resource constraints.

$$Profitability\ index = \frac{Value\ created}{Resource\ consumed} = \frac{NPV}{Resource\ consumed}$$

  – **PI rule:** When choosing among projects competing for the same resource, pick the set of projects with the highest PIs that can still be undertaken given the limited resource.

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[12]**Time value of money** means that a sum of money is worth more now than the same sum of money in the future. It can grow only through investing so a delayed investment is a lost opportunity.

- **Shortcomings of PI:**

  - It does not take into account the size of the project, so it is not accurate in some cases.
  - *Example: A large project with lower profit margins may have a lower profitability index than a smaller project with higher profit margins.*
  - Different combinations must be enumerated in order to find out NPV maximizing combination.
  - With multiple resource constraints, PI can break down completely.

4 Capital Budgeting

Capital Budgeting: A planning process used by a firm to determine if major projects or investments are worth the funding of cash capitalization structures (debt, equity or retained earnings)

4.1 Determining free cash flow (FCF) and NPV

- **FCF:** It is the cash a company generates after taking into consideration cash outflows that support its operations and maintain its capital assets. Thus, it is firm's extra cash after its operating expenses and other areas.

- **Methods of calculation of free cash flow:**

  - Direct calculation
  - Calculation from earnings

- **Two forms of free cash flow:**

  - **Free cash flow to the firm (FCFF):** FCF available to all providers of a firm's capital, including bondholders, shareholders and common stockholders.
  - **Free cash flow to the equity (FCFE):** FCF available to a firm's common (equity) stockholders

- **Direct calculation of FCF:**

$$FCF = \overbrace{(Revenue - Cost - Depreciation) * (1 - t_C)}^{\text{Unlevered net income}} + Depreciation - CapEx \\ - \Delta NWC$$

$$FCF = (Revenue - Cost) * (1 - t_C) - CapEx - \Delta NWC + t_C * Depreciation$$

With:

- FCF = Free cash flow, t_C = Corporate tax rate, t_C * Depreciation tax shield, CapEx = Capital expenditures, NWC = Net working capital

- **Calculation of FCF from earnings:**

Free cash flow of firm XY
Earnings before interest and taxes (EBIT)
− Adjusted tax expense
+ Depreciation
+ / − Change in net operating working capital
= Cash flow from operations
+ Cash flow from investments (capital expenditures)
= Free (project) cash flow

- **Forecasting earnings:**

  - **Capital budget:** Lists the investments that a company plans to undertake

  - **Capital budgeting:** Process used to analyze alternate investments and decide which ones to accept => using NPV to evaluate capital budgeting decisions

  - **Incremental earnings:** Amount by which the firm's earnings are expected to change as a result of the investment decision

- **Interest expense:**

  - In capital budgeting decisions, **interest expense**[13] is typically not included. Project should be judged on its own, not on how it will be financed.

  - **Note:**

    * Interest expense is taken into account in cost of capital, i.e. discount rate used for calculating NPV.
    * Hence, if we considered interest payments as an expense, there would be a **double counting**.

- **Tax considerations:**

  - **Marginal corporate tax rate:** The tax rate on the marginal or incremental dollar of pre-tax income. **Note:** A negative tax is equal to a tax credit[14].

$$\boxed{Income\ tax = EBIT * t_C}$$

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[13]An **interest expense** is the cost incurred by an entity for borrowed funds.

[14]**Tax credit** refers to an amount of money that taxpayers can subtract directly from the taxes they owe.

- **Note:**
  * Taxes paid by the company are lower as interest payment can be deducted from the tax base.
  * However, this **tax shield effect**[15] is taken into account in adjusting the cost of capital.
  * Tax shield effect while calculating project's cash flows => there would be double counting

- **Tax credit:**

  - **Rationale:** Typically, in a new project, EBIT may be negative over the first years.
  - **Profitable company:**
    * If the project takes place within an overall profitable company, we can calculate with negative tax payments, i.e. company is granted a tax credit.
    * Reason: The loss in project can be balanced against profits made in other business segments.
  - **Non-profitable company:**
    * If the overall company is not profitable, we have to set-up a tax carryforward[16] or (if allowed) a carrybackward.

- **Opportunity cost:** It is the forgone benefit that would have been derived from an option not chosen.

- **Project externalities:** Indirect effects of the project that may affect the profits of other business activities of the firm. **Cannibalization** is when sales of a new product displaces sales of an existing product.

- **Sunk costs:** costs that have been or will be paid regardless of the decision whether or not the investment is undertaken -> not to be included in incremental earnings analysis!

  - **Overhead costs:** fixed and not incremental to the project
  - **Past research and development expenditures:** Money that has already been spent on R&D is a sunk cost.
  - *They are both irrelevant for incremental (earning) analysis!*
  - *Reason: The decision to continue or abandon a project should be based only on the incremental costs and benefits of the product going forward.*

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[15]**Interest Tax Shield** refers to the tax savings resulting from the tax-deductibility of the interest expense on debt borrowings.

[16]A **tax loss carryforward** allows taxpayers to use a taxable loss in the current period and apply it to a future tax period. *Result in the future*: decrease in taxable income (taxable income - carried taxable loss) => lower amount of tax

- **Unavoidable competitive effects:**

  - When developing a product, firms may be concerned about the cannibalization of existing products.
  - If sales are likely to decline in any case as a result of new products introduced by competitors => these lost sales are a **sunk cost**

- **Real-world complexities:**

  Typically,

  - sales will change from year to year
  - average selling price will vary over time
  - average cost per unit will change over time

- **Capital expenditures and depreciation:**

  - **Capital expenditures:** Actual cash outflows when an asset is purchased -> included in calculating free cash flow
  - **Depreciation:** Non-cash expense[17] -> free cash flow estimate is adjusted for this non-cash expense

- **Net (operating working capital (NWC):)**

  - Most projects will require an investment in NWC.

$$NWC = Current\ assets - Current\ liabilities$$

$$NWC = Cash + Inventory + \underbrace{Receivables - Payables}_{\text{Trade credit}}$$

  - Increase in NWC:

$$\Delta NWC_t = NWC_t - NWC_{t-1}$$

- **Calculation of NPV:**

$$PV(FCF_t) = \frac{FCF_t}{(1+r)^t} = FCF_t * \frac{1}{(1+r)^t}$$

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[17]**Non-cash expenses** are business expenses that do not require the expenditure of cash. They do not have an effect on cash flow!

4.2 Choosing among alternatives

- **Rules for choosing among alternative projects:**

  - **Choosing between mutually exclusive investment opportunities:** Pick the opportunity with highest NPV
  - **Choosing between alternatives:** Only include those components of free cash flow that differ among the alternatives.

4.3 Further adjustments to FCF

- **Adjustments to FCF:**

  - **Other non-cash items:** Amortization
  - **Timing of cash flows:** Cash flows are often spread throughout the year
  - **Accelerated depreciation:** Modified accelerated cost recovery system (MACRS) depreciation
  - **Liquidation or salvage value:** Include (after-tax) liquidation or salvage value of any assets that are disposed of any depreciation
  - **Terminal or continuation value:** Market value of FCF from the project at all future dates
  - **Tax loss carryforwards or tax carrybacks**

4.4 Risk analysis

- **Break-even analysis:** Computes the level of a parameter that makes the project's NPV equal to zero (*break-even point*, where total cost = total revenue)

- **Sensitivity analysis:** Shows how NPV varies with a change in one of the assumptions, holding the other assumptions constant

- **Scenario analysis:** Considers the effect on NPV of simultaneously changing multiple assumptions

5 Cost of Capital

5.1 Equity of cost of capital

- **Intuition:** The cost of capital of any investment opportunity (cost of equity) equals the expected return of available investments with same beta[18].

- **Methods of estimating the equity cost of capital:**

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[18]**Beta** is a measure of risk calculated as a regression on the company's stock price.

– The Capital Asset Pricing Model (CAPM)

– Dividend discount model

– Bond yield plus risk premium[19]

- **CAPM:**

  – CAPM states that the expected return on equity equals the sums of the risk-free interest rate and a premium for bearing the market risk.

  – CAPM estimate / equation is provided by the security market line (SML) equation:

$$r_i = r_f + \underbrace{\beta_i * (E[r_{Mkt}] - r_f)}_{\text{Risk premium for security i (RP}_{\text{Mkt}})}$$

  With: r_i = Equity cost of capital, r_f = Risk-free rate, β_i = Return sensitivity of stock i to changes in the market return, $E[r_{Mkt}]$ = Expected return on the market, $E[r_{Mkt}]$ - r_{Mkt} = Expected market risk premium or **equity risk premium** (ERP)

  – Steps to implement CAPM and to calculate the equity cost of capital **r_i**:

  a-) Construct the market portfolio[20] and determine its expected excess return **$E[r_{Mkt}]$ - r_{Mkt}** of the (value-weighted) market portfolio

   · **The fundamental market risk premium:**

     - Two drawbacks of using historical data while estimating risk premium

     (a) large standard errors of estimates

     (b) backward looking => may not represent current expectations

     - One alternative is to solve for discount rate that is consistent with the current level of index

$$r_{\text{Mkt}} = \frac{Div_1}{P_0} + g = Dividend\ yield + Expected\ yield$$

  b-) Estimate the stock's beta $\boldsymbol{\beta_i}$ = sensitivity to the market portfolio
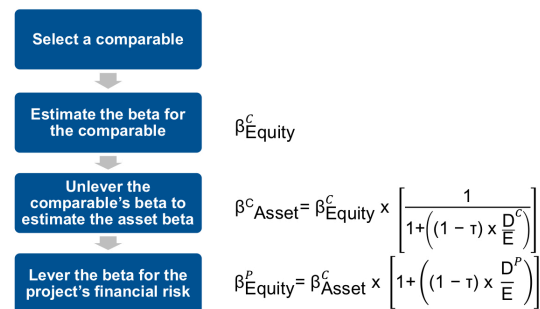
   · **Estimating beta from historical returns:**

     - Beta measures a security's "sensitivity to market" risk.

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[19]A **risk premium** is a measure of excess return that is required by an individual to compensate being subjected to an increased level of risk.

[20]**Market portfolio** is a value-weighted portfolio of all the securities traded in the market. Thus, it is used as a proxy, a market index. **Market indexes** report the value of a particular portfolio of securities.

- Beta is expected percent change in excess return of security for a 1% change in excess return of market portfolio
- **Method 1:** Beta is the slope of the best-fitting in the plot of a security's excess returns vs. market's excess returns -> regression analysis
- **Method 2:** Beta is calculated as the covariance of a stock with the market divided by the variance of the market:
  (a) Stock beta > 1.0: Stock is riskier than the overall market and has higher expected returns.
  (b) Stock beta < 1.0: Stock is less risky than the overall market and is expected to have lower returns.
· **Issues in estimating beta from historical returns:**
  - Judgement regarding estimation period, appropriate market index, use of a smoothing technique and adjustments for non-public or small company stocks
  - **For non-public companies**, we need to use comparable companies (with similar risk, size, etc.) to estimate beta:

Select a comparable

↓

Estimate the beta for the comparable β^{C}_{Equity}

↓

Unlever the comparable's beta to estimate the asset beta $\beta^{C}_{Asset} = \beta^{C}_{Equity} \times \left[\dfrac{1}{1 + \left((1-\tau) \times \frac{D^{C}}{E} \right)} \right]$

↓

Lever the beta for the project's financial risk $\beta^{P}_{Equity} = \beta^{C}_{Asset} \times \left[1 + \left((1-\tau) \times \frac{D^{P}}{E} \right) \right]$

5.2 Debt of cost of capital

- **Definition:** It is the effective interest rate that a company pays on its debts, such as bonds and loans.

- **Methods of calculating the debt cost of capital:**

  - **Yield-to-maturity approach:** Debt cost of capital = Yield to maturity on a firm's outstanding debt

  - **Debt-rating approach:** Debt cost of capital = Yield based on similarly rated debt (bonds) with similar maturity

  - **Beta-CAPM approach:** Debt cost of capital = Expected return for debt based on its beta using CAPM

- **Yield-to-maturity approach (YTM):**

- **Definition:** It is the IRR an investor will earn from holding the bond to maturity[21] and receiving its promised payments.
- **The accuracy of the estimate depends on the risk of firm default!**
  * **Low risk of firm default:** YTM is a reasonable estimate of investors' expected rate of return.
  * **High risk of firm default:** YTM will overstate investors' expected return.

- **Beta-CAPM approach:**
  - Debt betas are difficult to estimate because corporate bonds are traded infrequently.
  - One approximation is to use estimates of betas of bond indices by rating category.

5.3 A project's cost of capital

- **Should we undertake a given project?**
  - **Assumptions:**
    * All-equity financing of the project separate from any financing decision
    * Ignoring financing risk
  - **Answer: It depends, especially on project's cost of capital!**
    * To calculate project's cost of capital, we need to find a comparable company and estimate the cost of capital of assets as a proxy.
      · All-equity firm comparables (company operating by using its equity)
      · Levered firm comparables (company operating by taking out loans)

- **All-equity financing: Asset (unlevered) beta**

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

- **Levered firms as comparables: Asset cost of capital / unlevered cost of capital**

  - Expected return required by investors to hold firm's underlying assets.

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[21]**Maturity** is a date on which a financial agreement ends, triggering the payment of principal with interest or repayment of a loan with interest.

– Weighted average of firm's equity and debt costs of capital

$$r_U = r_E * \frac{E}{E+D} + r_D * \frac{D}{E+D}$$

- **Cash and net debt:**

  – Some items maintain high cash balances.
  – Cash is a risk-free asset that reduces the average risk of the firm's assets.
  – Since the risk of the firm's enterprise value is what we are concerned with, leverage should be measured in terms of net debt:

$$D = Net\ debt = Debt - Excess\ cash\ and\ short-term\ investments$$

- **Industry asset beta (unlevered beta):**

  – After adjusting for the leverage of different firms to determine their asset betas, we can combine estimates of asset betas for multiple firms in same industry.
  – Doing this will reduce estimation error of estimated beat for the project.

5.4 Project risk characteristics and financing

- **Differences in project risk:**

  – Firm asset betas reflect market risk of the average project in a firm.
  – Individual projects may be more or less sensitive to market risk.
  – Financial managers in multi-divisional firms should evaluate projects based on asset betas of firms in a similar line of business.
  – Another factor that can affect market risk of a project is its degree of operating leverage:
    * Operating leverage is relative proportion of fixed vs. variable costs.
    * A higher proportion of fixed costs increases sensitivity of the project's cash flows to market risk.
      · Project's beta will be higher.
      · A higher cost of capital should be assigned.

- **Weighted average of cost of capital (WACC):**

  – **Perfect capital markets:** where, the choice of financing does not affect cost of capital or project NPV, no trader has the power to change the price of goods or services

– **Taxes** – **A big imperfection:** When interest payments on debt are tax deductible, net cost to the firm is given by:

$$\boxed{Effective\ after-tax\ interest\ rate = r * (1 - t_C)}$$

- **WACC Formula:**

$$\boxed{r_{WACC} = r_E * \frac{E}{E+D} + r_D * \frac{D}{E+D} * (1 - t_C)}$$

- **Given a target leverage ratio:**

$$\boxed{r_{WACC} = r_U - \frac{D}{E+D} * t_C * r_D}$$

- **r$_{WACC}$ vs. r$_U$:**

  – Unlevered cost of capital (or pre-tax WACC) = r$_U$
    * Expected return investors will earn by holding firm's assets.
    * In a world with taxes, it can be used to evaluate an all-equity with the same risk as the firm.
  – In a world with taxes, WACC is less than the expected return of firm's assets.
    * With taxes, WACC can be used to evaluate a project with the same risk and the same financing as the firm.

6 Capital Structure

6.1 Equity vs. debt financing

- **Basic question of corporate finance = Capital structure decision:** After the decision whether or not to undertake an investment, which type of security should a firm sell to investors.

- **Definition:** The relative proportions of debt, equity, and other securities that a firm has outstanding. Two main types of capital structure:

  – **Financing a firm with equity** (= all-equity financing, unlevered firm)
  – **Financing a firm with equity and debt** (= levered firm)
  – **Is there a capital structure that shareholders prefer?**

6.2 Modigliani-Miller 1: Leverage and arbitrage

- **Capital structure decision:** The theory of capital structure was developed beginning with the capital structure theory of Merton Miller and Franco Modigliani (MM).

- **Assumptions of MM model:**

    - **Homogeneous expectations**
    - **Homogeneous business risk classes**
    - **Perpetual cash flows**
    - **Perfect capital markets:**
        * Investors and firms can trade the same set of securities at competitive market prices equal to the present value of their future cash flows.
        * No taxes, transaction costs, issuance costs or agency 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 info about them.

- **Modigliani and Miller argue:** In a perfect capital market, total value of a firm is equal to the market value of the total cash flows generated by its assets and is not affected by its choice of capital structure. <u>Reasons:</u>

    - Market value of any firm is independent of its capital structure.
    - If a company has a given set of assets, changing debt to equity will change the way net operating income is divided between lenders and shareholders, but will not change the value of the company.

- <u>MM proposition 1 (without taxes):</u> **The market value of a company is not affected by the capital structure of the company.**

$$\boxed{E + D = U = A}$$

With:
E = Market value of equity in a levered firm, D = Market value of debt in a levered firm, U = Market value of equity in an unlevered firm, A = Market value of the firm's assets

- **Proof of MM proposition 1:**

    - **Law of one price:** Firm's securities and its assets need to have the same total market value (whether the firm is unlevered or levered).
        * Otherwise, an arbitrage[22] opportunity would exit.

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[22]**Arbitrage** is the simultaneous purchase and sale of the <u>same asset in different markets</u> in order to profit from tiny differences in the asset's listed price.

– **Homemade leverage:** The investors use leverage in their own portfolios to adjust the leverage choice made by the firm.

    * Homemade leverage is a perfect substitute for corporate leverage
    * Substitutability between corporate debt and personal debt

- **A leveraged recapitalization: Application of MM proposition 1**

  – How do firms adjust their capital structure?
  – A firm can use borrowed funds to pay a large special dividend or repurchase a significant amount of outstanding shares.

6.3   Modigliani-Miller 2: Leverage and cost of capital

- **Basis of MM 2:** MM's first proposition can be used to derive an explicit relationship between leverage and the equity cost of capital.

- **MM proposition 2 (without taxes): 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 of debt-to-equity ratio.**

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

With:
r_E = Return on levered equity, r_U = Return on levered equity, r_D = Return on debt, D/E = Debt-to-equity ratio (market value)

- **Unlevered firm: Capital budgeting and WACC:**

  – If a firm is unlevered, all of the FCFs generated by its assets are paid out to its equity holders.

  – The market value, risk, and cost of capital for the firm's assets and its equity coincide. Therefore:

$$\boxed{r_U = r_A}$$

- **Levered firm: Capital budgeting and WACC:**

  – If a firm is levered, project r_A is equal to firm's r_{WACC}:

$$\boxed{r_{WACC} = r_U = r_A}$$

$$\boxed{r_{WACC} = r_U = r_A = r_E * \frac{E}{D + E} + r_D * \frac{D}{D + E}}$$

- With perfect capital markets, a firm's WACC is independent of its capital structure and is equal to its equity cost of capital if it is unlevered which matches the cost of capital of its assets.
- With no debt, WACC = unlevered equity cost of capital
- As firm borrows at the low cost of capital for debt, its equity cost of capital rises. Net effect is that firm's WACC is unchanged.

- **Computing WACC with multiple securities:**

  - If the firm's capital structure is made up of multiple securities, then WACC is calculated by computing the WACC of all the firm's securities.

- **Unlevered and levered betas:**

  - Effect of leverage on the risk of a firm's securities can also be expressed in terms of beta:

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

  $=> \beta_U$: 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.

  - Leverage amplifies the market risk of a firm's assets, β_U, raising the market risk of its equity β_E.

$$\beta_E = \beta_U + \frac{D}{E} * (\beta_U - \beta_D)$$

6.4 Capital structure fallacies

- **Equity issuances and dilution:**

  - **Dilution:** An increase in the total of shares that will divide a fixes amount of earnings
  - **Dilution vs. equity issuance:** It is sometimes (incorrectly) argued that issuing equity will dilute existing shareholders' ownership, so debt financing should be used instead.
  - As long as firm sells new shares of equity at a fair price, there will be no gain or loss to shareholders associated with the equity itself.
  - Any gain or loss associated with the transaction will result from NPV of the investments the firm makes with the funds raised.

- **Conversation of value principle for financial markets:**

– With perfect capital markets, financial transactions neither add nor destroy value, but instead represent a repackaging of risk (and therefore return).

– This implies that any financial transaction that appears to be a good deal may be exploiting some type of market imperfection.