EFR summary

Finance 1, FEB12003X

2022-2023

Lectures and Exercise Lectures 1 to 7

Weeks 1 to 7

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Details

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Finance 1 – IBEB – Lecture 1, week 1

Types of financial statements

Balance Sheet. Firm's financial position at a point in time (lists firm's assets and liabilities)
Income Statement. Firm's earnings (lists firm's revenues and expenses)
Statement of Cash Flows. Indicates the amount of cash generated by the firm.
Statement of Stockholders' Equity. Breaks down the stockholders' equity into issuing shares and retained earnings

Valuation indicators

As investors in a firm have a claim on the net cash it generates, the value of the firm is the present value of the stream of free cash flows the firm generates in the future.

Free cash flow (FCF) - the cash flow available for the company to repay creditors, pay dividends and interest to investors. One of the advantages of using FCF: it leaves out large capital expenditures and changes in cash due to changes in operating assets and liabilities

Book value versus market value

Book value is how accountants evaluate a firm based on the sum of the net profits that were not paid out as dividends over the lifetime of the company. This is the book value of the firm's equity (Equity= Assets - Liability).

Financial economists, on the other hand, assess the value of a firm's equity by looking at its **market value** (or market capitalisation). This equals # shares outstanding * stock price.

$$market - to - book\ (MB)\ ratio\ =\ market\ value\ of\ equity\ /\ book\ value\ of\ equity$$

When creditors and shareholders have more positive views on the firm's future than the suggestion from its book value, MB is often greater than 1. An obvious example is

the potentially huge difference between the market value and the book value of a (great) football player.

The **enterprise value** of a firm is the market value of the firm's (underlying) assets that generate cash flows. This is the cost one needs to pay when taking over the enterprise.

enterprise value (EV) = market value of equity + debt - cash.

Cash here is the excess cash that is not needed for the firm's operating activities and can be paid back to investors without harming the business. This is different from working capital (cash needed to run the firm).

Time value of money

When you hold shares in a company, you would receive a dividend annually. The value of the company's equity reflects the value of the future cash flows that the company pay-out to shareholders as dividends. These depend on the current dividend, the dividend growth and the opportunity costs of capital invested in the company.

Financial decisions are often made by comparing values:

1. Compound cash flow to move it forward in time
$$FV_n = C * (1 + r)^n$$
2. Discount cash flow to move it backward in time:
$$PV = \frac{C}{(1+r)^n}$$
3. Values can be compared only at the same point in time

Valuing a stream of cash flows

Annuities - cash flows for a set duration of time. Present value of a stream of cash flows is then a sum of the present values of each

$$PV = \sum_{n=0}^{N} \frac{C_n}{(1+r)^n}$$

Perpetuities - constant cash flow that occurs at regular intervals forever.

Growing perpetuity - perpetuity where the payments increase at a constant rate, g.

$$PV(perpetuity) = C/r$$
$$PV(growing\ perpetuity) = C/(r - g)$$

Discounting with the risk-free rate

Risk-free interest rate, r_f - interest rate at which money can be borrowed or lent without risk over that period

If future payments are risky, premium needs to be added to interest rate to account for riskiness. (higher risk -> higher interest rate)

Financial decision-making

Law of one price: If equivalent investment opportunities trade simultaneously in different markets, then the price of trading should be the same everywhere. If this law does not hold, then an arbitrage opportunity exists.

Cost-benefit analysis for an investment opportunity can be done by calculating the Net Present Value (NPV) using the formula:

$$NPV = PV(benefits) - PV(costs)$$

NPV decision rule: invest in the alternative with the highest NPV. Choosing this alternative is equivalent to receiving its NPV in cash today.

The net present value of a stream of cash flows can be valued by summing the discounted values of each future cash flow with the appropriate interest rates regarding the time distance.

Finance 1 – IBEB – Exercise lecture 1, week 1

Introduction to financial statement analysis

Firms' disclosure of financial information

Financial statements are the firm-issued accounting reports with past performance information. They are filled with the SEC (Securities and Exchange Commission). Financial statement analysis is used to compare the firm with itself over time, and compare the firm to other similar firms.

Balance sheet

A firm's balance sheet is a snapshot in time of the firm's financial position.
The balance sheet identity is given by:

Assets = Liabilities + Stockholders' Equity.

Assets: what the firm owns.

- Current assets: cash or assets that are expected to be turned into cash within a year. This category includes cash, marketable securities (short-term low-risk investments like government bonds), accounts receivable, inventories, and other current assets such as pre-paid expenses.
- Long-term assets include net property, plant, and equipment (book value=cost of acquisition-accumulated depreciation), goodwill and intangible assets and other long-term assets, such as investments in long-term securities.

Liabilities: what the firm owes.

- Current liabilities are to be paid within a year. This includes accounts payable, short-term debt/notes payable, current maturities of long-term debt, and other current liabilities such as taxes payable, wages payable.

*__Net working capital__ is the capital that is available in the short term to run the business:

Net working capital = current assets - current liabilities.

- Long-term liabilities consist of other liabilities with the maturity of longer than one year and include long-term debt, capital leases, and deferred taxes.

Stockholders' Equity: the difference between the value of the firm's assets and liabilities.

- Book value of equity could also be negative. The reason is that it is calculated as the difference between book value of assets and book value of liabilities. However, many of the firm's valuable assets may not be reflected in the balance sheet (for example: the firm's reputation).
- Market value of equity (Market Capitalization) is calculated by (Market price per share × number of shares outstanding). This cannot be negative and often differs substantially from book value.
- Market-to-book ratio (or Price-to-book ratio)

  $$market - to - book\ (MB)\ ratio = market\ value\ of\ equity\ /\ book\ value\ of\ equity$$

  Value stocks: $MB\ ratio < 1$
  Growth stocks: $MB\ ratio > 1$
- Total enterprise value (TEV)

  $$enterprise\ value\ (EV) = market\ value\ of\ equity + debt - cash$$

Income statement

Income statement is also known as a profit and loss account or statement of financial performance and it indicates the flows of revenues and expenses over a period of time. An important component of an income statement is the "bottom line" (net income = earnings in a period).

Earning calculations:

1. **Gross Profit** = Total sales(=Revenues) - Cost of Sales
2. **Operating Expenses** = Gross profit - Operating expenses (such as selling, general, and administrative expenses; R&D; depreciation and amortization).
3. **Earnings before interest and taxes (EBIT)** = Operating income + other income - other expenses.
4. **Pre-tax Income** = EBIT + interest income - interest expense
5. **Net Income** = Pre-tax income - Taxes
6. **Earnings per share (EPS)** = Net Income / Number of shares outstanding

Statement of Cash Flows

Net income typically does not equal the amount of cash the firm has earned, because it includes non-cash expenses such as depreciation and amortization, and excludes cash uses such as investment in property, plant, and equipment or expenditures on inventory.

A statement of cash flows can be used to calculate free cash flows (FCF) and enterprise value. It includes three sections:

1. **Operating Activity:** Adjusts net income for all non-cash items related to operating activities and changes in net working capital.
   Adjustments:

- Depreciation / amortization: add the amount of depreciation / amortization (as a non-cash expense)
- Account receivable: deduct the increases (as the cash is not yet been received)
- Accounts payable: add the increases (cash have not been paid yet)
- Inventories: deduct the increases (any increases in inventory are paid by cash)

2. **Investment Activity:** all cash required for investment activities

- Capital expenditures (purchasing PPE)
- Trading of marketable securities
- Acquisition related expenditures

3. **Financing Activity:**

- Payments of dividends (cash outflow, therefore is deducted)
  retained earnings = net income - dividends
- Changes in borrowings (increases in borrowings are cash inflows)

Financial decision making

Financial decisions are based on costs and benefits at the same moment in time. We can express the value in terms of money today (PV) or in terms of money in the future (future value).
Investment should be made when $PV(benefits) > PV(costs)$.

$$NPV = PV(benefits) - PV(costs) \rightarrow NPV > 0$$

Arbitrage and the law of one price

Arbitrage refers to taking advantage of the price difference when buying and selling equivalent goods in different markets. An arbitrage opportunity occurs when it is possible to make a profit without taking any risk or making any investment.
Normal market is a competitive market in which there is no arbitrage opportunity.
Law of One Price: If equivalent investment opportunities are traded at the same time in different normal markets, then they must trade for the same price in both markets.

Time value of money

PV shortcut formulas

Perpetuities

- Constant cash flow: $PV = \frac{C}{r}$
- Growing cash flow: $PV = \frac{C}{(r-g)}$

Annuities

- Constant cash flow: $PV = \frac{C}{r} \times \left[1 - \frac{1}{(1+r)^n}\right]$
- Growing cash flow: $PV = \frac{C}{r-g} \times \left[1 - \left(\frac{(1+g)}{(1+r)}\right)^n\right]$
  (g=growth rate; n=number of periods; C=cash flow; r=interest rate)

Interest rates

Effective Annual Rate (EAR) indicates the total amount of interest that will be earned at the end of one year. Typically used in present value calculations for yearly cash flows as it considers the effect of compounding. Also referred to as the Effective Annual Yield (EAY) or Annual Percentage Yield (APY).

Annual Percentage Rate (APR) indicates the amount of simple interest earned in one year.

Simple interest is the amount of interest earned without the effect of compounding. The APR is typically less than the EAR.
* Note that the APR cannot be used as a discount rate without adjustments made.

The APR with k compounding periods is a way of quoting the actual interest earned each compounding period:

$$Interest\ Rate\ per\ Compounding\ Period\ =\ APR\ /\left(\frac{k\ periods}{year}\right)$$

To convert an APR to an EAR, we can use the following formula:

$$1\ +\ EAR\ =\left(1\ +\frac{APR}{k}\right)^{k}$$

Finance 1 – IBEB – Lecture 2 and Exercise lecture 2, week 2

Valuing bonds

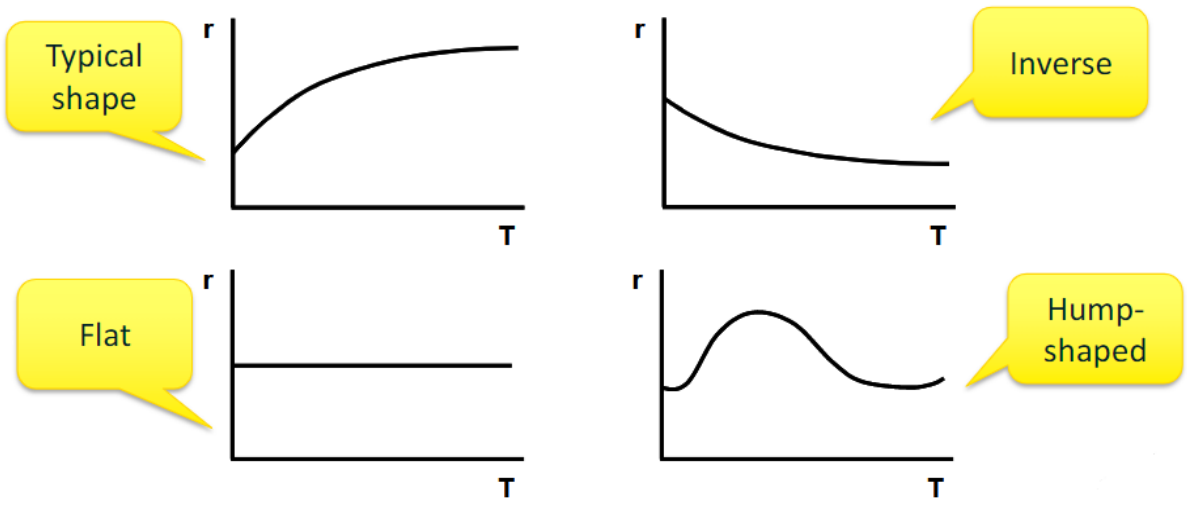
Bond is a tradable loan, which generally has a fixed maturity and fixed coupon payments (cash flow stream).

The length of a bond can vary, but the coupons of bonds can also be different as well. The coupon can be a **fixed percentage** of the principal loan, it can be related to inflation or profit (**variable**), or there may be no coupon (**zero-coupon bonds**).
Price of the bond is the discounted value of cash flows:

$$Price\ =\ \sum_{t=1}^{T} CF_{t}\ /\ (1\ +\ R_{t})^{t}$$

Term structure

The **term structure** of interest rates indicates how interest rates vary with the maturity at one point in time. The most typical case depicts an upward-sloping term structure, because the longer the time until maturity the higher the interest rate.



Slide 10, Lecture 2, dr. Laurens Swinkels (2022)

The bond **yield** is another way to express the bond price:

$$Price = \sum_{t=1}^{T} CF_t / (1 + R_t)^t = CF_t / (1 + Y)^t$$

*Interpretation of Y: weighted average of spot rate used for discounting.

Spot rates and forward rates

The difference between the spot rate (r) and forward rate (f) is that the spot rate always starts at time t=0 and lasts until a further point in time regardless how far this point is. But forward rates last from one point in time to the next point in time. The law of one price must hold, therefore the general formula for period n:

$$(1 + f_{n-1,n}) = (1 + r_n)^n / (1 + r_{n-1})^{n-1}$$

Risk of default

First, we assumed bonds were riskless, but in reality there is always some risk involved. Therefore, we use a **credit spread** to define the risk of default. The credit spread uses for its calculation the average default loss and the risk premium of holding credit risk.

$$Credit\ spread = Compensation\ for\ expected\ loss + Credit\ risk\ premium$$

$$Price = \sum_{t=1}^{T} \frac{Promised\ CF_t}{(1+R_t+credit\ spread)^t} = \frac{Expected\ CF_t}{(1+R_t+credit\ risk\ premium)^t}$$

For all public corporate bonds, the credit spread can be calculated, but the expected default loss and risk premium apart are not. We also have agencies to check the credit quality of firms.

Investment decision rules

Cash flows

It is important to keep in mind that costs and revenues are different from cash outflows and cash inflows. Costs are incurred, and revenues are generated in a period, while a cash inflow or outflow occurs at a moment in time. This implies that profit or earnings is not equal to cash inflow minus cash outflow. Different accounting methods may influence NPV, for example through tax payments. The timing/type of depreciation influences the NPV of a cash flow, the earlier depreciation the higher NPV.

$$NPV = \sum_{t=0}^{T} CF_t / (1 + R_t)^t = -INV_0 + \sum_{t=1}^{T} CF_t / (1 + R_t)^t$$

An investment is attractive when $NPV > 0$

Duration of the projects

When choosing from the projects with different duration, we have to extend the timeline of the projects as fair comparison can be done only if periods are equal. We can use the m-year replacement-investment formula to calculate the NPV:

$$NPV_{\infty,m} = NPV_m \times \left(\frac{1}{1-1/(1+r)^m} \right)$$

Inflation rate

In the Fisher-equation we can derive the real interest rate, inflation and nominal interest rate when two of these are given:

$$(1 + k) = (1 + i) \times (1 + r)$$

where k=nominal interest rate; i=inflation; r=real interest rate

Important for deciding on projects, is that for nominal cash flows, we have to use the nominal interest rate, the same holds for real cash flows and the real interest rate. Taxes are calculated on nominal cash flows.

Investing with limited budget

If we have to deal with a limited budget when investing, there are three steps to take. First, we will start by looking at the possible combinations of projects that are available. When we have all project combinations, we have to cancel out the combinations that are infeasible. Finally, the project combination with the highest NPV is chosen given the budget.

Profitability index (PI) can be used to identify the optimal combination of projects to invest in under the budget constraint. Rank projects by PI and select the ones with the highest indicator.

$$PI = \frac{value\ created}{resource\ consumed} = \frac{NPV}{resource\ consumed}$$

Alternative investment decision rules

The pay-back period (PBP) and the internal rate of return (IRR) can both be used to help with investment decisions. They can be useful, but there is still a possibility they give the wrong answer. The NPV is always considered the most favourable method.

The pay-back period (PBP) can be found with the following formula:

$$INV_{t=0} \leq \sum_{t=1}^{PBP} CF_t$$

In this formula we assume r=0, when r is bigger than zero, it is an economic pay-back-period (adding non-discounted cash flows). The smallest value of PBP for which the formula holds is the pay-back period. A problem with this method is that only cash flows in the specific period are taken into account, and what happens after that is not considered. Even though the answer is not always correct, this alternative method is used because of uncertainty in the long run, because the future is hard to predict.

The **internal rate of return (IRR)** is the interest rate at which the NPV of an investment project equals zero. If $IRR > r$ this indicates that $NPV > 0$ and hence it is attractive to

do the project. The IRR can only be deduced by trial and error and the formula is such that:

$$0 = \sum_{t=0}^{T} CF_t / (1 + IRR)^t$$

A few problems with IRR are that it ignores the size of a project, and with longer duration projects where reinvestment is assumed this might be a disadvantage. In case of positive and negative cash flows there is a possibility for multiple IRRs to exist with positive and negative interest rates when NPV is zero.

Capital budgeting

The process of analysing investment opportunities and deciding which one to choose is called capital budgeting.
Incremental cash flows = the difference between doing and not doing the project.
Cannibalization occurs when the introduction of a new product has an adverse impact on the sales of existing products.
Opportunity cost - the revenue that could have been earned with an alternative use of the asset.
Sunk costs - unrecoverable costs that are already incurred and therefore irrelevant for the decision making.

$$net\ working\ capital = current\ assets - current\ liabilities$$

$$Free\ Cash\ Flow = (Revenues - Costs - Depreciation) \times (1 - \tau) + Depreciation - \Delta NWC - CapEx$$

Uncertainty

- **Break-even** analysis: this analysis finds the value of a parameter for which the $NPV = 0$. After this we can determine how likely it is that the parameter value is below or above the break-even amount
- **Sensitivity** analysis: input assumptions in this analysis will be changed within a plausible range, which will affect the NPV.
- **Scenario** analysis: in this analysis, the values of parameters will be determined for multiple scenario's, like a best case and worst case. These scenarios will be compared by their NPV when multiple parameters are changed at the same time.

Valuing stocks

For bonds, the cash flows were known, they consisted of coupons and a principal. But stock only pays dividends, we get the value of what is left of the earnings of a company, which are not known in advance. There are two ways to estimate the value of a stock: **Dividend Discount Model (DDM)** or estimating the **value using comparable firms**.

Dividend Discount Model (DDM)

$R_E = R_t + \ equity\ risk\ premium.;$ $\qquad P_0 = \frac{div_1}{1+r_E} + \frac{P_1}{1+r_E} \Rightarrow r_E = \frac{div_1}{P_0} + \frac{P_1 - P_0}{P_0}$

where $\frac{div_1}{P_0}$ represents dividend yield, and $\frac{P_1 - P_0}{P_0}$ the capital gains rate. If we assume there will be no dividend growth, we use the following formula to calculate the value of a stock:

$$P_0 = \sum_{t=1}^{\infty} div\ /\ (1 + R_E)^t$$

The **Gordon growth model** assumes a constant dividend growth, g, shown in the formula:

$$P_0 = \sum_{t=1}^{\infty} (div \times (1 + g)^{t-1})/\ (1 + R_E)^t = \frac{div}{R_E - g}$$

But there are some disadvantages in this model. Everything is very dependent on the first dividend forecast, if this is wrong, this has a big impact on the value of the stock. Also, the growth rate cannot be bigger than the equity cost of capital here.

Multiple valuation of comparable stocks

A company does not have to pay all earnings, they can keep them as retained earnings, which they can use for new investments.

$div_t = EarningsPerShare_t \times Dividend\ payout\ rate\ (k)_t$

$$EPS = \frac{earnings_t}{shares\ outstanding}$$

By combining this formula with dividend discount model we can arrive at P/E ratio:

$$\frac{Price}{Earnings} = \frac{k}{R_E - g}$$

Finance 1 – IBEB – Lecture and Exercise lecture 3, week 3

Valuing stocks

Information

The first version of the three levels of informational efficiency was constructed by Fama in 1970:

- Weak: The stock prices reflect all information on its historical price. In technical analysis, trends of history are used to predict the future, but these cannot be considered useful.
- Semi-strong: the prices of the stock are based on the publicly available information which is relevant for pricing. The prices adjust to public information.
- Strong: not only is the publicly available information reflected in the prices, but also insider information of firms which is not yet public to all investors.

Lessons from efficient markets

Efficient market hypothesis - when relevant information is available it is immediately and completely reflected in prices, therefore it is not possible to systematically achieve abnormal profits.

For investors to have positive-NPV trade opportunities, competitive advantage is needed, with low transaction costs, no regulation, no benchmark index, etc. In this scenario, research is not needed and investors can just buy stock at or close to fair value.

Corporate managers should focus on finding positive-NPV projects in real markets, they will be fairly financed. Analysts will focus on free cash flow to determine the value.

In efficient markets, no arbitrage opportunities can exist. The same amount of risk corresponds to the same expected return. To determine whether a market is efficient, we need a theory for risk and return.

Capital markets and the pricing of risk

Risk and return measures

Expected return

$$E[R] = \mu = \sum_{all\ possible\ R} probability_R \times R$$

Variance - indicates how much the squared deviation from the mean is, which can be calculated with the formula:

$$variance = E\left[(R - E[R])^2\right] = \sum_{all\ possible\ R} probability_R \times (R - E[R])^2$$

The standard deviation, σ(R), which is the square root of the variance, in Finance is also known as **volatility**. It measures how returns vary with the spread of the distribution of the return. The bigger the volatility, the higher the risk, which is compensated with a higher return..

$$volatility = standard\ deviation = \sigma = \sqrt{variance}$$

Covariance

$$cov_{AB} = \sum_{j=1}^{z} p_j \times \left[R_{A,j} - E\left(R_A\right)\right] \times \left[R_{B,j} - E\left(R_B\right)\right]$$

Historical returns

Historical average can (but does not need to) be a forecast for the expected return in the future. The same goes for the volatility measure. In the variance estimate the average realized return is used instead of the mean, because we do not know the mean, and this will be the best estimate. After this the standard deviation, also known as the volatility estimate, is calculated as the square root of the variance.
How much historical data should be used?

- More data gives more accurate estimates for parameter
- If there is a structural break, using data after the break could give better estimates as the data will be more relevant

Formula when estimating using sample of historical returns

Expected return: $E(R_A) = \overline{R_A} = \frac{1}{N}\sum_{t=1}^{N} R_{A,t}$

Variance: $\sigma_A^{\ 2} = \frac{1}{N-1}\sum_{t=1}^{N}\left[R_{A,t} - \overline{R_A}\right]^2$

Covariance: $cov_{AB} = \frac{1}{N-1}\sum_{t=1}^{N}\left[R_{A,t} - \overline{R_A}\right] \times \left[R_{B,t} - \overline{R_B}\right]$

Positive linear correlation $cov_{AB} > 0$

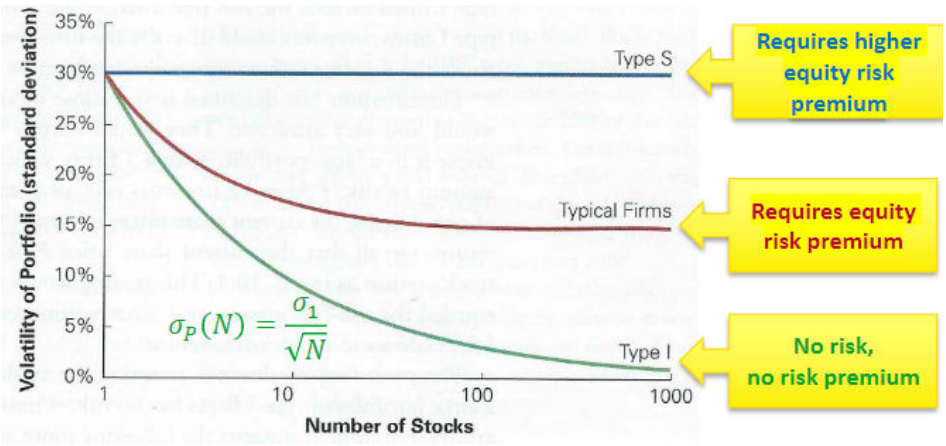
Negative linear correlation $cov_{AB} > 0$

Correlation coefficient: $\rho_{AB} = \frac{cov_{AB}}{\sigma_A \sigma_B}$

Diversification in stock portfolios

There will be no risk premium for diversifiable(=idiosyncratic) risk, thus investors will not be compensated for holding firm-specific risk. This is because if they diversify their portfolio, this risk will be eliminated for free. A risk premium will be determined by the systematic risk(Type S), which cannot be avoided even when a portfolio is diversified. In the graph below for firms of Type I, when the number of stocks in a portfolio increases, there will be an elimination of diversifiable risk. If we keep increasing the number of stocks, in the end the volatility of the portfolio will be equal to the market correlated risk.

$$volatility = total\,risk = systematic\,risk + diversifiable\,risk$$



Slide 13, Lecture 3, dr. Laurens Swinkels (2023)

An efficient portfolio is diversified to the maximum and will only have systematic risk. The risk of this portfolio cannot be reduced further.

$$Sharpe\ ratio = \frac{Portfolio\ excess\ return}{Portfolio\ volatility} = \left(E\left[R_P\right] - R_F\right)/\sigma R_P = \frac{reward}{risk}$$

What should determine the expected return of an asset

β - the sensitivity of the asset to movements of the market portfolio;
The expected percentage change in the excess return of an asset for a 1% change in the excess return of the market portfolio. (Beta is a measure of systematic risk)

$$\beta_i = \frac{cov\left(R_i, R_{mkt}\right)}{var\left(R_{mkt}\right)} = \frac{\sigma\left(R_i\right) \times \rho\left(R_i, R_{mkt}\right)}{\sigma\left(R_{mkt}\right)}$$

$$E\left[R_i\right] = risk\ free\ rate\ +\ risk\ premium\ = R_f + \beta_i \times \left(E\left[R_m - R_f\right]\right)$$

Optimal portfolio choice

The portfolio weight is the fraction of a stock in the total portfolio held by an individual. Thus, if we have n different investments, we call this an n-stock portfolio.

$$portfolio\ weight\ (w_i) = \frac{value\ of\ asset\ i}{total\ value\ of\ portfolio};\ \sum_{i=1}^{N} w_i = 1$$

Also, the expected return of a portfolio will be equal to the sum of the expected returns of all investments held in the portfolio.

$$E\left[R_p\right] = \sum_{i=1}^{N} w_i \times E\left[R_i\right]$$

And the variance of the return of this portfolio can be calculated with:

$$Var\left[R_p\right] = \sum_{i=1}^{N}\sum_{j=1}^{N} w_i \times w_j \times Cov\left\{R_i, R_j\right\}$$

When choosing an efficient portfolio, we want to choose the lowest risk given a certain level of expected return, or if the risk is given, we will want to maximise the expected return.

Finding minimum variance portfolio

$$min\left(w_1, w_2\right) w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_{12} \qquad ; w_1 + w_2 = 1$$

$$\Rightarrow min\left(w_1\right) w_1^2\sigma_1^2 + \left(1 - w_1\right)^2\sigma_2^2 + 2w_1\left(1 - w_1\right)\sigma_{12} \qquad ;\partial/\partial w_1 = 0$$

$$\Rightarrow w_1 = \frac{\sigma_2^2 - \sigma_{12}}{\sigma_1^2 + \sigma_2^2 - 2\sigma_{12}}$$

Capital Asset Pricing Model (CAPM)

Assumptions:

1. There will be a fixed amount of securities in the market, which is the total supply of all tradable securities. We use historical information to predict the future. Therefore, we have homogeneous expectations about the return and risk of securities between investors;
2. Investors buy and sell at competitive market prices (no transaction costs);
3. All investors perceive the same efficient portfolio;
4. Borrow and lend at the same risk-free rate. If an investor chooses a point on the capital market line (CML) between the market portfolio and the risk-free investment, he will lend, but if he invests beyond the market portfolio point on the CML, he will borrow.

CAPM implies that investors hold a portfolio that consists of two assets:

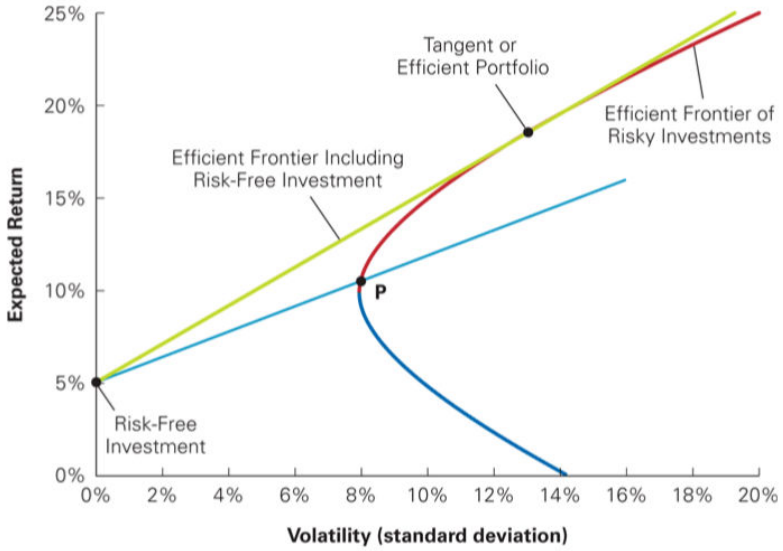
1. Market portfolio
2. Risk-free investment

In proportion depending on their risk aversion
Therefore, they trade if risk aversion changes or market portfolio changes.

Capital market line

The capital market line (CML) is the best expected return that can be obtained for each level of the total risk(volatility).
The slope of this formula is also called the *Sharpe ratio*.

All the stocks and portfolios that are to the right of the CML have some diversifiable risk, on the CML we only have systematic risk.



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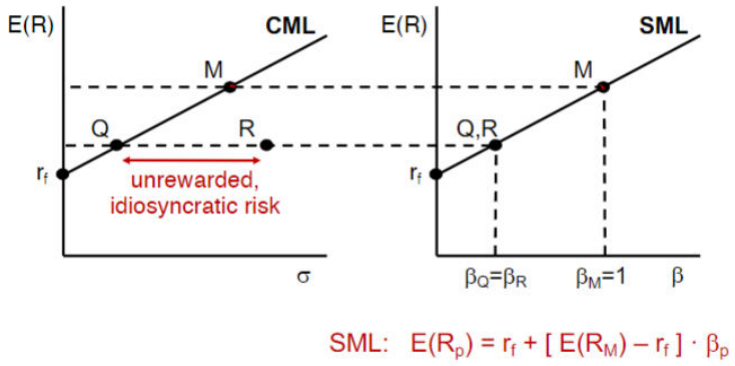
Security market line

The security market line (SML) goes through the points of risk-free investment and market portfolio. If there will be a negative beta for a security, this means the security does well when the market is not doing well. The expected return of the security will be lower than that of Rf, the risk premium is smaller than zero, but this does not mean it is risk free. This security can be held with other securities to diversify the portfolio, but this does decrease the return.



Slide 44, Exercise Lecture 3, Renée Spigt (2023)

The SML matches the expected return for each security with the corresponding beta to the market. Because all stocks and portfolios are part of the efficient market portfolio, they should lie on the SML.

Beta(β) of a Portfolio

The beta of the portfolio corresponds to the weighted average beta of the securities in the portfolio and can be calculated using the formula:

$$\beta_p = \frac{cov\left(\sum_i w_i R_i, R_{mkt}\right)}{var\left(R_{mkt}\right)} = \sum_i w_i \frac{cov\left(R_i, R_{mkt}\right)}{var\left(R_{mkt}\right)} = \sum_i w_i \beta_i$$

Finance 1 – IBEB – Lecture 4 and Exercise lecture 4, week 4

Cost of capital

Resources are not obtained by a firm for free, because this amount could have been used to find other projects. Thus, the opportunity cost of using this resource is equal to the value it would have when using the resource for the best possible alternative. The cost of capital of an investment is the expected return of available investments with the same beta.

- Debt cost of capital
- Equity cost of capital
- Project cost of capital

Equity cost of capital

The CAPM can be used to estimate cost of capital by the Security Market Line (SML) equation: $r_i = r_f + \beta_i \times \left(E\left(R_{mkt}\right) - r_f\right)$

The Market Portfolio

Value-Weighted Portfolio - a portfolio that consists of securities that are held in proportion to their market capitalization.

A Value-weighted portfolio is also an **Equal-Ownership portfolio** as it contains an equal fraction of the total number of shares outstanding of each security in the portfolio.

Additionally, it is also a **Passive portfolio** that does not require rebalancing even if market prices change.

In a portfolio like the market portfolio the investment in each security i is proportional to its market capitalization:
$MV_i = \#\ Shares\ outstanding\ \times\ Price\ of\ i\ per\ share$

The weight of each security in the portfolio can be calculated as follows:

$x_i = \frac{Market\ Value\ of\ i}{Total\ Market\ Value\ of\ all\ securities} = MV_i \,/\, \sum_j MV_j$

The Market Risk Premium

The risk-free rate is most commonly determined by the yield on US Treasury securities.

Market risk premium can be approximated by so-called **market indices**. For example, S&P 500 (value-weighted portfolio), Wilshire 5000 (value-weighted portfolio), DJIA (price-weighted portfolio).

The expected return on the market can be determined using the historical average of market return. However, there is a drawback for using historical data. It is backward looking and, hence, may not be representative of expectations about the future.

Possible alternative could be to look at what is implied by the market and solve for the discount rate: $r_{mkt} = \frac{div_1}{P_0} + g = Dividend\ yield + Expected\ dividend\ growth\ rate$

Beta estimation

Using historical returns we can estimate beta- the sensitivity of returns on security to return on market portfolio.

Linear regression can be applied to estimate the excess return on stock i (dependent variable) with market excess return (independent variable):

$$\left(R_i - r_f\right) = \alpha_i + \beta_i\left(R_{mkt} - r_f\right) + \varepsilon_i$$

Where α_i is the intercept term, $\beta_i\left(R_{mkt} - r_f\right)$ is the sensitivity of the stock to market risk and ε_i is the error term (zero on average)

Essentially, α_i is the measure of historical return on stock against the estimation of SML. Positive alpha means that historical return on stock was better than predicted by CAPM, negative alpha means that historical return was below SML.

Debt cost of capital

Yield to maturity is the IRR an investor will earn from holding the bond to maturity and receiving its promised payments.
Yield to maturity is a reasonable estimation of investors' expected rate of return if there is little risk of default. If there is a high risk of default, yield to maturity exceeds investors' expected return.
Expected return of the bonds can be calculated using the formula:

$$r_d = (1 - p)y + p(y - L) = y - pL =$$
$$= Yield\ to\ Maturity - probability\ of\ default \times Expected\ loss\ rate$$

Project's cost of capital

All-equity comparables

To measure the compensation for the risk of a new project when it is fully equity financed, but different from the average project in the company, we want to find an all-equity financed firm with similar business operations to a new project for comparison. By using comparable firm's beta and cost of capital we can estimate the cost of capital for the new project. If it is not possible to find an all-equity financed firm we can also make estimates from a levered firm (financed by both debt and equity) with similar business activities. As a result of having debt financing the return on equity will be higher due to higher risk. Hence we want to use the unlevered cost of capital.

The unlevered cost of capital- the expected return required by investors to hold all assets of the firm. The assets of a firm generate cash flows with their corresponding risk, which is transferred to the debt and equity of the firm. The debt and equity holders do have claims on the cash flows of the firm's assets. Debt holders are safe in the payments, because the coupons have to be paid regularly, and the principal of these loans has to be repaid at the maturity which is limited to a number of years. Debt holders always get paid first, and after them, the equity holders. Because debt holders have more rights of these payments, the r_D is relatively low. The weighted average of the firm's equity and debt cost of capital can be calculated using the formula:

$$r_u = r_a = \frac{E}{E+D} \times r_E + \frac{D}{E+D} \times r_D$$

where r_a stands for return on assets

*note: assumption of the "perfect" world without taxes etc. implies r_u won't change if capital structure changes

Similar equation can be obtained for unlevered beta because the beta of the portfolio is the weighted average of the betas of the securities included in the portfolio:

$$\beta_u = \frac{E}{E+D} \times \beta_E + \frac{D}{E+D} \times \beta_D$$

*note: assumption of the "perfect" world without taxes etc.

When calculating $\frac{D}{E+D}$ration it is important to use the net debt. This is because cash is a risk-free asset that reduces the average risk of a firm's assets. Therefore:

$$Net\ Debt = Debt - Excess\ cash - Short\ term\ investments$$

Operating Leverage is the proportion of fixed to variable costs of the project. A higher proportion of fixed costs implies higher sensitivity of the project's cash flows to market risks, meaning higher beta and cost of capital.

The Weighted Average Cost of Capital (WACC)

When the assumption of the "perfect" world is relaxed, we need to account for taxes.

$$Effective\ after - tax\ interest\ rate = r\left(1 - \tau_c\right)$$

The Weighted Average Cost of Capital is then equal to:

$$r_{WACC} = \frac{E}{E+D} \times r_E + \frac{D}{E+D} \times r_D \times \left(1 - \tau_c\right)$$

Given a target leverage ratio:

$$r_{WACC} = r_u - \frac{D}{E+D} \times \tau_c r_D$$

Where r_u is unlevered cost of capital or pre-tax wacc

WACC (r wacc) and pre-tax WACC (r u)

Unlevered cost of capital shows the expected return on holding a firm's assets, which in the real world with taxes can be used for evaluation of all-equity projects with the same risk as the firm.
Taking in account taxes, WACC adjusts for the capital structure of the firm.

Investor behaviour and capital efficiency

Competition and Capital markets

Stock's alpha- the difference between a stock's expected return and its required return according to the security market line (CAPM return). When the market portfolio is efficient all stocks are on SML. If there is no deviation from SML, alpha is equal to zero.

Stock's alpha: $\alpha_s = E[R_s] - r_s$

Security market line: $r_s = r_f + \beta_s \times (E[R_{mkt}] - r_f)$

Deviation from SML

Stock prices adjust to news

- Positive alpha (=higher expected return)
- Investors buy at a lower price than CAPM prediction until expected returns go down again
- The stock is back on SML

Information and rational expectation

In CAPM investors should hold a combination of market portfolio and a risk-free investment.
The market portfolio can be inefficient if

- Information was misinterpreted by a substantial number of investors;
- A significant number of investors are willingly hold inefficient portfolio because they also care about other aspects of portfolios other than returns and volatility

Systematic trading biases

Biases become problematic when they occur systematically instead of randomly.
Some common biases are:

- Disposition effect- tendency to hold losing stocks for too long, as investors do not want to realise losses
- Herd behaviour- occurs when individuals start actively following each other

Multiple factor model

CAPM used so far is an example of a single-factor model.
Multi-factor model of risk is used where there are other factors that explain returns, hence, CAPM proposed portfolios may not be efficient. In this case, to construct efficient portfolios we need to use factor portfolios that are covering different risk factors.

Multifactor model of risk for given N factor portfolios:

$$E[R_s] = r_f + \beta_s^{F1} \times \left(E[R_{F1}] - r_f\right) + \beta_s^{F2} \times \left(E[R_{F2}] - r_f\right) + \ldots + \beta_s^{FN} \times \left(E[R_{FN}] - r_f\right) =$$
$$= r_f + \sum_{n=1}^{N} \beta_s^{FN} \times \left(E[R_{FN}] - r_f\right)$$

Self-financing portfolio

A self-financing portfolio can be constructed by going short in some stocks and long in others with the same market value.

For self-financing factor portfolios the formula comes down to (as the risk free rate drops out):

$$E[R_s] = r_f + \beta_s^{F1} \times E[R_{F1}] + \beta_s^{F2} \times E[R_{F2}] + \ldots + \beta_s^{FN} \times E[R_{Fn}] =$$
$$= r_f + \sum_{n=1}^{N} \beta_s^{FN} \times \left(E[R_{FN}]\right)$$

Arbitrage Pricing Theory (APT)

There are no systematic possibilities available to investors for arbitrage, therefore the arbitrage pricing relationship (APR) holds:
$E[R_i] = \lambda_0 + \beta_{i,1}\lambda_1 + \beta_{i,2}\lambda_2 + \ldots + \beta_{i,k}\lambda_k$
Where λ_0 corresponds to risk-free rate, other λ are risk premiums for different factors that together measure the systematic risk, β is the sensitivity of the security to each risk factor.

Finance 1 – IBEB – Lecture and Exercise lecture 5, week 5

Capital structure in a perfect market

The **capital structure** of a firm indicates whether the firm's assets are financed with equity or debt. An **unlevered firm** will only use their own resources to finance projects. A **levered firm** instead used debt and sometimes equity to finance the projects.

Modigliani-Miller

Notation: 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 firm's assets.

Proposition I: In the presence of a perfect capital market, the cash flows generated by a firm's assets equals the total value of the firm, and this cannot be affected by the chosen capital structure of the firm.

$$E + D = U = A$$

Changes in capital structure only affect the distribution of the cash flows among stakeholders, but not the cash flows themselves. Financing with more debt will make equity more risky, so higher equity cost of capital will offset the low debt cost of capital.

As previously discussed, the return on unlevered equity is related to the returns of levered equity and debt: $R_u = R_a = \frac{E}{E+D} \times R_E + \frac{D}{E+D} \times R_D$
Solving for R_E: $R_E = R_u + \frac{D}{E}(R_u - R_D)$

Proposition II: Following from rewritten formula, the cost of capital of levered equity is equal to the cost of capital for unlevered equity plus an additional risk premium due to leverage, that is proportional to the firm's market value debt-to-equity ratio.

Beta: Similarly, the effect of leverage on the risk of security can be expressed in terms of beta: $\beta_E = \beta_u + \frac{D}{E}(\beta_u - \beta_D)$

Equity Issuances

Dilution- an increase in the total number of shares that will divide a fixed amount of earnings.

If a firm issues new shares, there will be no gain or loss for the shareholders if the shares are sold at a fair price. This is because the price of the share has to remain constant. But we do have **earnings dilution** in this case, this is because the same amount of earnings now has to be divided among more shares. Which leads us to the **dilution fallacy**, that if a firm starts issuing equity, this will reduce the value of the existing shares of the shareholders. But here it is not taken into account that if a firm starts issuing new shares, the cash earned by a firm will increase, thus a firm will have more assets and higher cash flows. The increases of this will be equal to the dilution of the shares. The fallacy should not affect the decision on equity vs debt financing.

Capital structure with corporate tax

Until now we assumed that the capital structure a firm chooses does not influence the value of the firm in a perfect capital market. But in fact, the amount of leverage a

firm has does affect the value of the firm via the corporate tax. Firms have to pay tax on their EBIT. The interest expense is the amount of payments made to debt holders, and the left-over cash flows that are paid to debt holders. The income before taxes are deducted is the pre-tax income. The corporate taxes will be the corporate tax rate, τ_c times the earnings of a firm minus the interest payments. The net income a firm will have left is the cash flow which can be used to pay equity holders, $(1-\tau_c)(EBIT - r_D D)$. As the interest expense reduces the amount of corporate tax, it incentivises the use of debt. The reduction in taxes paid due to interest expenses can be calculated as follows:

$$Interest\ Tax\ Shield = Corporate\ Tax\ Rate \times Interest\ payments$$

Modigliani-Miller with taxes

Proposition I: the value of firms with leverage will be higher than that without leverage due to tax savings from the debt a firm has.

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

If the debt a firm has issued comes due, it will be refinanced with new debt. This way the debt is permanent, and they use the interest tax shield as a perpetuity.

$PV(Interest\ Tax\ Shield) = \tau_c D$

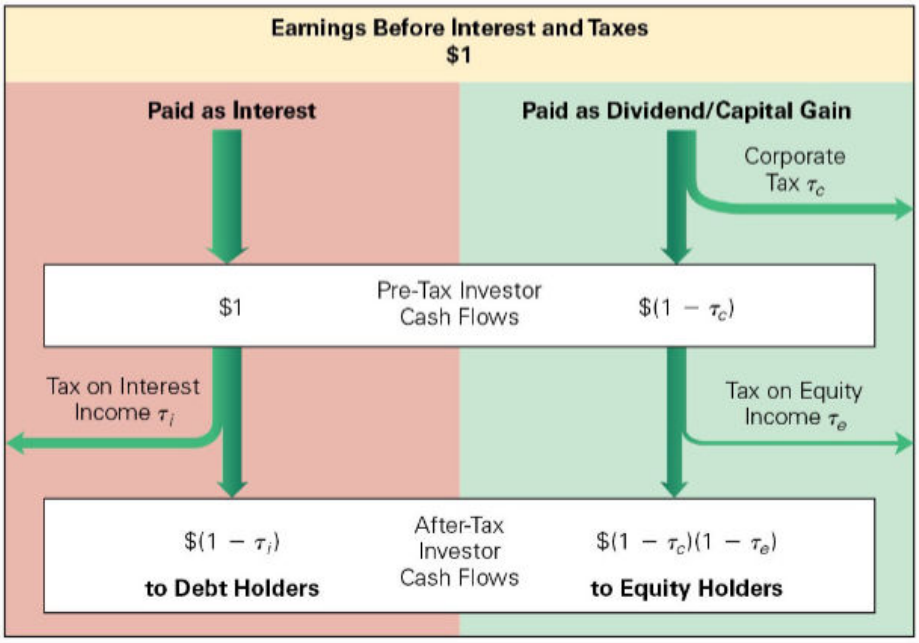
Adjusting WACC

The weighted average cost of capital (WACC) (including taxes) will give us the effective after-tax cost of capital to the firm, where the reduction of the interest tax shield is taken into account. The Weighted Average Cost of Capital is then equal to:

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

Capital structure with corporate tax and personal taxes

Notation: τ_c - corporate tax rate, τ_i - personal tax rate on interest payments (debt income), τ_e - personal tax rate on dividends and capital gains (income from equity)



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Now we assume that individuals also pay taxes, debt holders pay tax on interest payments, which is typically taxed as income, and equity holders pay taxes on dividends. The effective tax advantage of debt can be computed as follows:

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

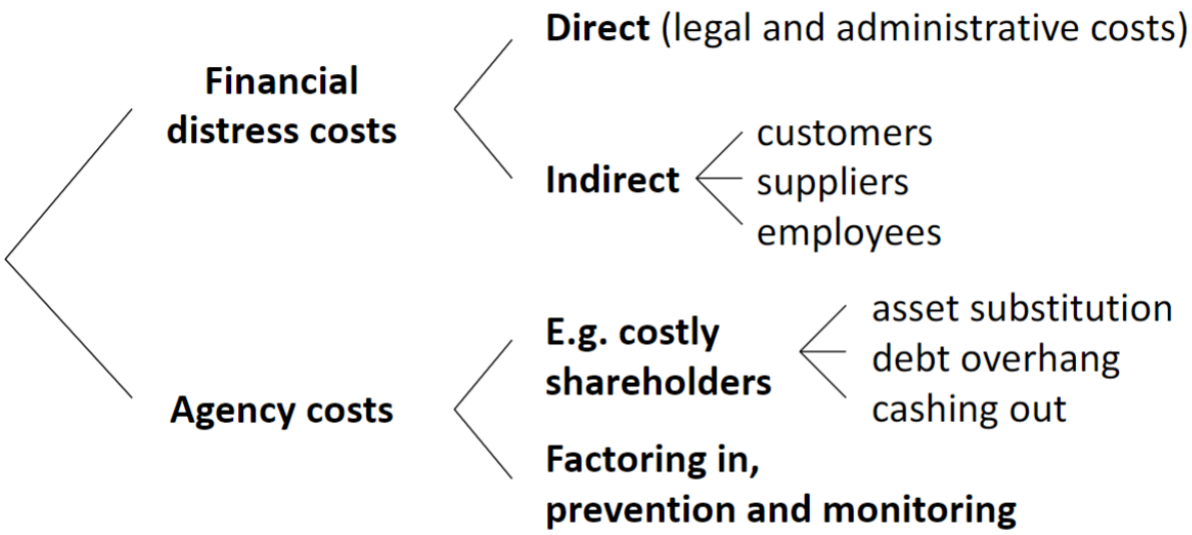
With personal taxes, the firm's equity and debt cost of capital will adjust to compensate investors for their tax burdens, therefore, WACC will be calculated using the same formula as before:

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

Financial distress, Managerial incentives and Information

In reality, most firms shield one third of their firm's EBIT from the corporate tax. A higher amount of debt increases the tax benefits of having debt. If the cash flows of a firm are not stable, this causes trouble estimating the EBIT and the appropriate amount of debt. Due to this it is as well possible a firm has trouble with paying the debt obligations that are due, as a result of unstable cash flows **(financial distress)**. Equity holders only receive dividends if there is money to pay them, but debt holders

need to receive their payments because this is their right. A firm **defaults** If it fails to make any of these payments to debt holders. Leverage increases the risk of bankruptcy as debt is a formal commitment to pay the debt holder, whereas in equity financing a firm is not obligated to pay dividends. Debt holders will receive certain rights to the assets of the firm, when a default in the firm has occurred. A **bankruptcy** of a firm shifts ownership of the firm from equity holders to debt holders. This does not have any effect on the total value which is available to all investors.



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The cost of capital of debt will be higher than the risk-free rate. When debt is low and leverage increases, the cost of capital for equity holders will be higher because risk is shared among more equity holders. But this is compensated by higher returns. But as debt keeps increasing the cost of capital for debt will start to rise as well, which is the same for the cost of equity but less strong.

The costs of bankruptcy can be divided among two groups, the direct and indirect costs. The **direct costs** of financial distress include the hiring of professionals from outside (e.g. legal advice). Both the firm and the creditors will hire these professionals. This will decrease the value of the firm's assets. **Indirect costs** of financial distress consist of multiple possible losses. These might include loss of customers if they decide to switch to a competitor knowing the firm is at risk of bankruptcy. The more firms rely on trade credit, the bigger the cost due to loss of suppliers will be. The loss of employees can also have a significant impact on costs.

Tradeoff theory

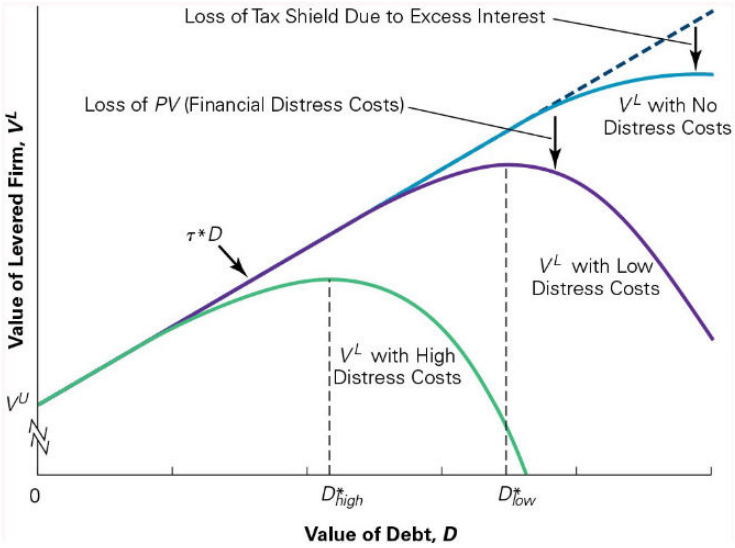
According to tradeoff theory, the firm will balance equity and debt in its capital structure by taking into account the benefits of the tax shield and the costs of financial distress..

Therefore, the total value of a levered firm is equal to the value of unlevered firm plus the present value of interest tax shield minus the present value of financial distress costs.

$$V^L = V^U + PV(Interest\ Tax\ Shield) - PV(Financial\ distress\ costs)$$

The present value of financial distress costs is determined by the three following causes:

1. The probability of financial distress
2. Magnitude of the costs
3. The discount rate of distress costs



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Agency costs

Agency costs are costs that are incurred when there are different interests between the holders of a firm. The costs will be created due to the conflicts between debt and equity holders that need to be solved due to the amount of leverage a firm chooses.

And there will be principal agent problems as well due to conflicts between shareholders and managers in a firm, because of different objectives and that the ownership and control is in two different places.

Excessive risk-taking

When a firm is in financial distress it may choose to engage in very risky activities with a small probability of large gains. In a firm, shareholders will be the owners of a firm, but they bet on risk with the money of the debt holders, which is known as **risk shifting**. Due to this, shareholders will take more risky assets instead of low-risk ones, for example by implementing a project with negative NPV, which is known as the **asset substitution problem.**

Under-investment

When a firm is in financial distress it may also choose not to invest in a new low-risk and NPV-positive project. Because part of the project gains will go to debt holders to resolve the financial distress, NPV to equity holders will be reduced and may even be negative, thus the shareholders would decline the project. the agency cost of debt reflected is the debt overhang.

Cashing out

Shareholders may liquidate assets below the market value when a firm with a lot of debt is on the verge of bankruptcy to pay out the proceeds as dividends.

Leverage ratchet effect

The **leverage ratchet effect** is an agency cost of leverage as well.

1. Shareholders may have an incentive to increase leverage even when this does decrease the value of the firm.
2. Or the shareholders will not decrease leverage by buying back, even though this would increase the firm value.

If a firm would start issuing more debt, the r_D will increase, wealth will be transferred from debt holders to equity holders. Even though the firm value is reduced by increasing leverage, it does benefit shareholders.

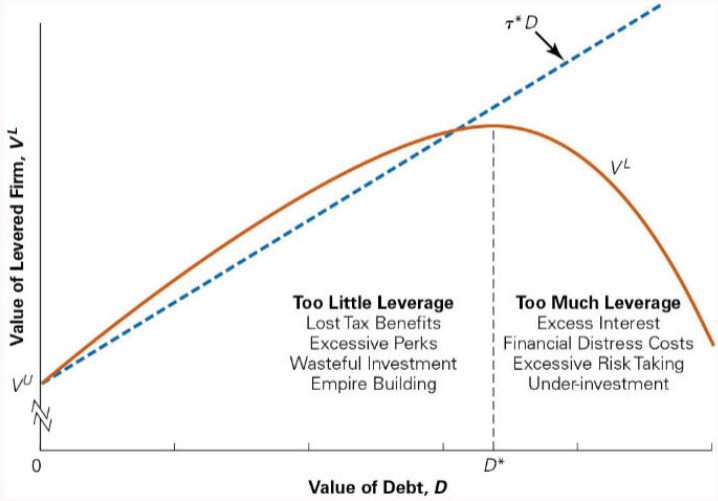
Debt Covenants

Since the interests of shareholders are different from those of debt holders, loans often include **debt covenants** to tackle this issue and restrict firm's actions.

Optimal leverage with Taxes, Financial distress and Agency costs

For the optimal level of debt there will be a trade-off between the tax shield of debt against the costs of financial distress and agency costs, which is known as the trade-off theory

$$V^L = V^U + PV(Interest\ Tax\ Shield) - PV(Financial\ distress\ costs) - PV(Agency\ cost\ of\ debt) + \\ + PV(Agency\ benefits\ of\ debt)$$



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The optimal debt level

R&D intensive firms: Firms with high R&D expenditures and low current free cash flow. Because of a low EBIT the tax shield needed is very small thus there is only a little bit of debt.

Mature firms: usually have stable cash flows, tangible assets and fewer investment opportunities. Because tangible assets will have a high liquidation value, the financial

distress costs will be low. The optimal level of debt for mature firms will be higher than that of growing firms

Information

Asymmetric information is existent when the managers of a firm for example have superior information compared to investors about the future cash flows of a firm. With asymmetric information the parties will not all have the same information thus the assumptions that securities are fairly priced are not accurate any more. The investors will get this information via press releases, and penalties will be there for when intentionally no or wrong information is given.

The credibility principle states that an action will only be credible if the costs of taking this action would be too costly if the event was not true. When debt is used to signal some kind of information to investors, this is called the **signalling theory of debt**.

Pecking-Order theory

Similarly to trade-off theory, **Pecking-Order theory** explains the choice capital structure of a firm. In this case, the key assumption is asymmetric information, meaning the management of the company is informed better about the prospects, risks and future profitability of the company than outside capital providers. Because of that, capital providers tend to ask for a higher premium to compensate for information asymmetry. The signalling effect then causes the pecking order of financing, in which the firm will use the cheapest form of financing first. In this theory, using retained earnings is the cheapest way of financing with a lowest degree of asymmetric information, whereas issuing new shares (new equity) is considered the most expensive and used only if other sources are already exhausted.

$$Internal\ financing \rightarrow New\ debt \rightarrow New\ equity$$

Issuing equity

A seller can give some information via the way he is selling his product. Because the bigger his desire to sell, the higher the probability the product is of low quality.

Adverse selection is when buyers and sellers have different information about the product. The **Lemons principle** states that when sellers have private information

about the product and its value, buyers are likely to ask for lower prices because they do not know of which quality the product will be.

The Lemons principle implies that firms who start issuing new equity will sell these stocks at a discounted price to investors because investors are not willing to pay this much due to the possibility that bad news will be announced.

Finance 1 – IBEB – Lecture and Exercise lecture 6, week 6

Payout policy

Uses of free Cash Flow

Assuming a perfect capital market, a firm has several options to choose from to use free cash flows. Free cash flows can be paid out: used to repurchase shares or to pay dividends. Cash flows can also be retained: used to increase cash reserves or invest in new projects (however assuming a perfect capital market, **free cash flows** is money left *after* investing in all NPV-positive projects)

Dividends

At the **declaration date**, known as the announcement date as well, the board of a firm authorizes the dividend that will be paid to shareholders. **Record date** specifies the date on which the shareholder has to be on record to receive the dividend. The stock is said to trade before the ex-dividend date at the **cum-dividend price**, denoted as P_{cum}. Investors who buy a stock of this firm on or after the **ex-dividend date** (two days before record date) will not receive a dividend, the price after ex-dividend date is known as P_{ex}. **Payable/ Distribution date** is a date on which the dividends are distributed to the shareholders.

$$P_{cum} = Current\ Dividend + PV(Future\ Dividends)$$
$$P_{ex} = PV(Future\ Dividends)$$

The difference between the P_{cum} and P_{ex} is the value of the dividend that is paid out to everyone who purchased shares before the ex-dividend date. In other words, in a perfect capital market the share price drops when a dividend is paid out by the amount of dividend.

Types of dividends

Regular dividends- a certain dividend paid on a regular basis.
Special dividend- a one-time payment that is typically larger than a regular dividend.
Stock dividend- a firm pays a dividend in a form of shares instead of cash to its shareholders.

Share repurchase

A firm can use the cash it has generated to repurchase outstanding shares today. If a firm does this, no dividends are paid to current shareholders, but in the future the dividend received will be higher (earnings will be divided between lower number of shares outstanding). Due to this the price of the stock will not be affected by the share repurchase: $P_{rep} = P_{cum} = Div + P_{ex}$.

Types of repurchase

Open market repurchase- a firm announces that it intends to repurchase shares and executes it as any other investor.
Tender offer- company offers to buy shares at a predetermined price, which is usually around 10-20% higher than a current market price.
Targeted repurchase- a company approaches a specific shareholder and buys the shares directly from that shareholder (can be used to prevent potential takeover).

Investor's preference

An investor may have a preference to own cash or stock. When there is no dividend pay-out by the company, but the investor decides to raise cash he can sell his shares which is known as a **homemade dividend**.

In case if the company pays out the dividend, investors can also use the dividend pay out to purchase additional shares.

Modigliani-Miller Dividend Policy Irrelevance

Proposition states that in a perfect capital market, when firm' investment policy is fixed, the choice of the firm on the dividend policy will not affect the initial share price.

Tax disadvantage of Dividends

In the world with taxes shareholders pay dividend tax on dividends received as well as tax on capital gains when they sell their shares. Dividend tax is often higher than tax on capital gains, which makes shares repurchase more attractive.

Signaling

Dividends

Empirical evidence shows that managers prefer a long-term target level for their dividends as a fraction of earnings, and investors prefer stable dividends with sustained growth. If the dividends a firm pays out are relatively constant over time, this is called **dividend smoothing**. It occurs more often that a dividend payment will increase, than that they will cut on dividends.

A firm signals information via their dividend payments, known as the **dividend signalling hypothesis**. This is because dividend changes reflect the expectations of the management about the firm's future earnings. Thus, firms may raise their dividends in expectation of a significant increase in long term earnings.

On the other hand, change in dividends may not always signal the change in long term earnings, but also the investment opportunities. A firm may cut on dividends to instead invest in attractive positive NPV project. Similarly, an increase in dividends may mean a lack of investment opportunities.

Repurchase

Share repurchase can be viewed as a sign that the shares are underpriced, as otherwise it would be too costly to execute. Thus, assuming management has better information about future prospects of the firm, investors may take share repurchase announcement as positive news.

Retaining cash

In the capital market without imperfections such as taxes, the firm is indifferent between retaining excess cash after investing in all NPV-positive projects and paying it out. However, when corporate taxes are introduced, there is a trade off when saving excess cash. The cash will be equal to the negative leverage. If holding debt gives a tax advantage, this means that holding cash will give a tax disadvantage. As raising capital is costly, those costs will be reduced if a firm has retained cash, on the other hand agency costs(e.g. wasteful behaviour) and tax expenses will increase.

Assuming a firm has already invested in NPV-positive projects it is left to invest in negative-NPV projects. Instead, a firm can purchase financial assets. The value of a firm will not be affected as in perfect capital market security trade is a zero-NPV transaction.

Modigliani-Miller pay-out irrelevance

The proposition states that in a perfect capital market, when a firm decides to invest excess cash into financial securities, the choice of the firm between pay-out and retention will not affect the firm's value.

Issuance and Distress costs

Firms often retain cash in case of potential future cash shortfalls, to be able to cover future positive-NPV investments if there is a chance that future earnings might not be sufficient. The cost of holding cash for future expenses should be compared to the cost reduction of financing through new debt or equity issues.

Raising Equity Capital

Looking at the stock markets, it is notable that nowadays, the number of companies listed on the market is less than there were in the past. This can be explained by the fact that more companies are financing themselves by means of private equity

Private equity

Young firms normally prefer to finance their business by equity rather than debt, because of the risk sharing advantage and more flexible payments to investors. One of the financing options for a small private firm in their early stage is to find **angel investors** who provide the initial capital to start their business.

A **venture capital firm** is a limited partnership that specializes in raising money to invest in the private equity of young firms. **General partners** are the ones who run the venture capital firm. **Limited partners** - the outsiders, invest at a cost of around 2% fee for management, and around 20% of any positive returns. They can benefit from the diversification, and the expertise of the general partners. Institutional investors, such as universities and pension funds, are typically limited partners.

A **private equity firm** is organised very much like a venture capital firm, but it invests in the equity of existing privately held firms rather than a start-up company. The investment is often initiated by finding a publicly traded firm and purchasing the outstanding equity. This way of taking the company private is in a transaction called a **leveraged buyout** (LBO).

Institutional investors are organisations such as pension funds, insurance companies and foundations who either directly invest in different assets or by acting as a limited partner in a venture capital firm.

Corporate investors- a corporation investing in private companies, usually for strategic reasons on top of financial returns.

Initial Public Offering (IPO)

The **initial public offering** is the process of selling stock to the public for the first time.
Advantages: greater liquidity

better access to capital

Disadvantages: equity holders become more widely dispersed, making it difficult to monitor management

has to satisfy all of the regulatory requirements of public companies.

An **underwriter** is an investment banking firm that manages the IPO process and helps the firm sell its stock. The lead underwriter is the primary firm involved, which is responsible for managing a security issuance. The syndicate is a group of underwriters who jointly underwrite and distribute a security issuance.
During an IPO, the shares sold may represent either a primary offering or a secondary offering. **Primary offering** is the case if the shares are being sold to raise new capital, and **secondary offering** is when the shares are sold by existing investors of the firm.

For smaller IPOs, a **best-efforts** basis is a situation in which the underwriter does not guarantee that the stock will be sold, but instead tries to sell the stock for the best possible price. Such deals often have an **all-or-none clause**, which means either all of the shares are sold on the IPO or the deal is called off.

Firm commitment is an agreement between an underwriter and an issuing firm, in which the underwriter guarantees that it will sell all of the stock at the offer price. When an underwriter provides a firm commitment, there is a risk that the banking firm will have to sell the shares at a lower price than the offer price incurring a loss.

Auction IPO is a method of selling new issues directly to the public, where the underwriter takes bids from investors and then sets the price that clears the market, instead of setting a price itself and then allocating shares to buyers.

Valuation

There are two ways to value a company:

1. Computing the present value of the estimated future cash flows
2. Estimating the value by examining comparables (recent IPOs).

Road show - A company's senior management and its underwriters travel around promoting the company and explaining their rationale for an offer price to the underwriters' largest customers, which are mainly institutional investors such as mutual funds and pension funds.

Book building is a process used by underwriters for coming up with an offer price based on customers' expressions of interest.

Lock up- is a restriction on selling shares by existing shareholders for some time (often around 180 days) after an IPO.

IPO underpricing

In general, the IPOs are underpriced, which means that on the first day of trading the offer price is typically less than what the market is willing to pay for it after the first day. The underwriters usually set the issue price so that the average first-day return is positive. The underwriters benefit from the under-pricing because it allows them to manage their risk. However, the pre-IPO shareholders bear the cost of under-pricing. In effect, these owners are selling stock in their firm for less than they could get in the aftermarket.

It is sometimes hard to estimate market demand when a firm goes from private to public. If the market believes that the IPO is going to do well the demand exceeds supply and the allocation of the shares to each investor will be rationed, however if there is insufficient demand at the issue price, all initial orders will be fulfilled. **Winner's Curse** is a term referring to a situation in competitive bidding when the high bidder, by virtue of being the high bidder, has very likely overestimated the value of the item being bid on. If the market believes the IPO is going to perform poorly, however as an individual investor you are not yet informed, you get all the shares requested, when demand for the shares by others is low and a high chance of incurring large negative returns.

Seasoned equity offering (SEO)

A seasoned equity offering (SEO) is the sale of stock by a company that is already publicly traded to raise additional equity, and many of the steps in the process are the same as for an IPO. The main difference is that the price-setting process is not necessary, as a market price already exists. Similarly to IPO there are Primary and Secondary shares.

There are two types of SEOs: **cash offer** (when new shares are sold to anyone who is interested) and **rights offer** (when new shares are offered only to existing

shareholders). Rights offer is a way to protect the existing shareholders from underpricing. The stock price reaction to an SEO is negative on average, which is consistent with adverse selection. Price declines occur as issuing shares is more attractive when the firm is overvalued, therefore investors may be unwilling to buy new equity.

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Mergers and Acquisitions

Background and facts

Mergers can be horizontal, vertical, or conglomerate. **Horizontal mergers** are ones where the target and the acquirer are in the same industry. **Vertical merger** is the case where the target's industry buys from or sells to the acquirer's industry. Lastly, the **conglomerate merger** is mergers involving target and acquirer operating in unrelated industries.

Acquirer can either pay for the acquisition with cash or with stock. The latter is known as **stock swap**, where the target shareholders are swapping old stock for new stock in either the acquirer or a newly created merged firm.

The **acquisition premium** is paid by an acquirer in a takeover, it is the percentage difference between the acquisition price and the pre-merger price of a target firm. Research has found that acquirers pay an average premium of 43% over the pre-merger price of the target. However, it is also observed that when a bid is announced, target shareholders enjoy a gain of 15% on average in their stock price

Reasons to acquire

The main reasons for an acquisition to take place are:

1. Synergies:

    - Economies of scale and scope
    - The control provided by vertical integration
    - Expertise of the target
    - Production/operating efficiency gains
    - Diversification (this can benefit the acquirer because of increased borrowing capacity and tax savings)
2. Monopolistic power gains
3. Managerial motives

Synergies usually fall into two categories: cost reductions and revenue enhancements. **Cost-reduction** synergies are more common and easier to achieve because they generally translate into layoffs of overlapping employees and elimination of redundant resources. **Revenue-enhancement** synergies, on the other hand, are much harder to predict and achieve. Additionally, one of the costs associated with an increase in size is that larger firms are more difficult to manage.

Vertical integration refers to the merger of two companies in the same industry that make products required at different stages of the production cycle. Vertical integration can be effective to prevent the hold-up problem.

With developing technologies firms are often in need of **expertise** in particular areas. Instead of hiring separate experienced workers it can be more convenient to acquire the required expertise as an already functioning firm.

Diversification is another significant reason for firms to acquire other companies.

- Reduced risk - Like a large portfolio, large firms bear less unsystematic risk, so often mergers are justified on the basis that the combined firm is less risky. However this argument ignores the fact that shareholders can achieve diversification of the portfolio themselves.
- Cost of debt - debt capacity and borrowing costs are more favourable after the acquisition. All else being equal, larger firms are more diversified and, therefore, have a lower probability of bankruptcy. That is, with a merger, the firm can increase leverage and thereby lower its costs of capital.
- Asset allocation - diversified conglomerate may benefit by being able to quickly reallocate assets across industries. However, there could also be agency costs: profitable divisions may subsidize money-losing ones for longer than is optimal.
- Liquidity - the liquidity that the bidder provides to the owners of a private firm can be valuable and often is an important incentive for the target

shareholders to agree to the takeover. This is because shareholders of private companies often have a disproportionate share of their wealth invested in the private company.

There can also be problems associated with a merger:
Monopoly gains. Most countries have antitrust laws that regulate mergers and acquisitions. This is because merging with or acquiring a major rival enables a firm to substantially reduce competition within the industry and thereby increase profits that can reduce consumer welfare.

Managerial motives. Conflicts of interest happen when managers prefer to run a larger company due to additional pay and prestige. Managers may decide to take over companies, because they themselves fear a take-over.

Valuation and offers

A key issue for takeovers is quantifying and discounting the value added as a result of the merger. For simplicity, any additional value created will be referred to as the **takeover synergies**. The price paid for a target is equal to the target's pre-bid market capitalization plus the premium paid in the acquisition. If the pre-bid market capitalization is viewed as the stand-alone value of the target, then from the bidder's perspective, the takeover is a positive-NPV project only if the premium it pays does not exceed the synergies created.

The offer

Once the valuation process is over the acquirer is ready to make a **tender offer**, which is not always successful and might require a raise to complete the deal. Bidder can pay for a target in cash or stock.

In a **stock-swap transaction**, the bidder pays for the target by issuing new stock and giving it to the target shareholders. The bidder offers to swap target stock for acquirer stock. The **exchange ratio** is the number of bidder shares received in exchange for each target share. A stock-swap merger is a positive-NPV investment for the acquiring shareholders if the share price of the merged firm exceeds the pre-merger price of the acquiring firm.

The acquirer's share price should increase post-acquisition if:

$$\frac{A+T+S}{N_A+x} > \frac{A}{N_A} = P_A$$

where A is the pre-merger value of acquirer, T is the pre-merger value of target, S is the value of synergies created and x is the number of new shares to pay for the target.

The condition to achieve a positive NPV project: $xP_A < T + S$

Exchange ratio: $\frac{x}{N_T} < \frac{P_T}{P_A}\left(1 + \frac{S}{T}\right)$

Risk and uncertainty

For a merger to proceed, both the target and the acquiring board of directors must approve the deal. A **friendly takeover** is when a target's board of directors supports a merger, negotiates with potential acquirers, and agrees on a price that is ultimately put to a shareholder vote. A **hostile takeover** is a situation in which an individual or organization purchases a large fraction of a target corporation's stock and in doing so gets enough votes to replace the target's board of directors and CEO. "Poison pill" is one of the methods used against the hostile takeover and it involves allowing existing investors to buy shares at substantial discount to dilute the holdings of new investors.

Merger "arbitrage"

The risk associated with probability of success of announced takeover adds volatility to the stock price after the tender offer is announced. This creates an opportunity for speculation on the outcome of the deal.

Who gets the value added from an acquisition?

Evidence suggests that the premium the acquirer pays is approximately equal to the value it adds, which means the target shareholders ultimately capture the value added by the acquirer. It does not appear that the acquiring corporation generally captures this value, because of the free rider problem and competition.

The free rider problem: As a result of acquisition and potentially change in firm's management, the share price of the target firm will increase. However, the

non-tendering shareholders can “free ride”. By not tendering, these shareholders will see the value of their shares increase. If all shareholders feel that the value will increase, they will all not tender their shares and the deal will not go through. The only way to persuade shareholders to tender their shares is to offer them at least the price they expect the price will rise to, which removes any profit opportunity for the **corporate raider** (- the acquirer in a hostile takeover).

Acquirers often choose to pay so large a premium due to the **competition** that exists in the takeover market. Once an acquirer starts bidding on a target company it becomes clear that a significant gain exists, therefore, other potential acquirers may submit their own bids. The result is effectively an auction in which the target is sold to the highest bidder

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