Corporate finance

Indholdsfortegnelse

Topic 1: Introduction & financial statements

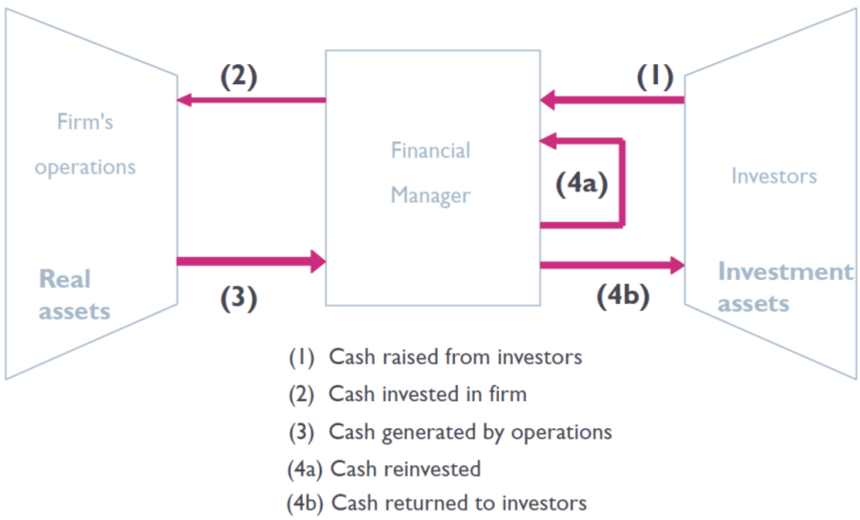
Chapter 1: Goals and Governance of the firm

Investment decision (capital budgeting)

- Invest in which kind of assets?
- Tangible: plants, machinery, etc.
- Intangible assets: patents, brands, etc.

Financing decision

- Raising money that the firm need for its investments and operations
- Capital structure
  - The mix of debts and equity financing



Goals of the corporation

- Shareholders want to maximize their wealth
  - What is the best way to do this?
  - Maximize the current market value of shareholders' investment in the firm
- Why not just maximize:
  - Profits?
  - Pay outs to shareholders?
- Do managers always maximize shareholders' wealth?

- What might they be maximizing instead?
- What is the root of this behavior?

Separation of ownership and management
Owners typically do not run the company day-to-day. They typically hire managers.

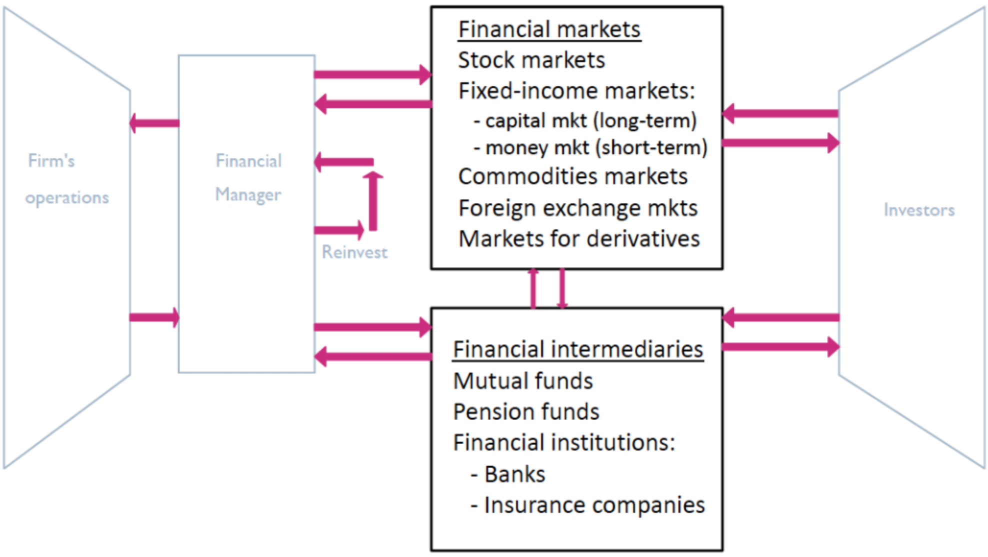
- **Advantage:** Not plausible for thousands of owners to collectively run the business. Ownership can change without interfering with the operation of the firm.
- **Disadvantage:** Agency problems, due to conflict of interest between management and owners. Information asymmetries: owners do not have the same detailed information as managers.

Addressing agency problems

1. Compensation plans
    a. Align incentives
2. Board of directors
    a. Monitor management
3. Takeovers
    a. Poor performance increases probability of takeover and the replacement of management (by new owners)
4. Specialist monitoring
    a. Stock market analysts, lenders (e.g. banks), activist shareholders/blockholders, etc., monitor management
5. Legal and regulatory requirements
    a. Ensures monitoring by auditors, who are directly responsible (SEC, FSA, etc.)

Chapter 2: Financial markets and institutions

Financial markets: Where securities are issued and traded
Financial intermediaries: Organizations raising money from investors and providing financing for: individuals, corporations and other organizations.



- Compare to earlier flow diagram

Functions of financial markets and intermediaries

- Transporting cash across time (Your future self has to repay a loan for instance)
- Risk transfer and diversification
- Liquidity (Ability to quickly transact asset to cash)
- Payment mechanism (Checks, credit cards, electronic transfer, etc.)
- Provide information (Commodity prices, interest rates, company values and stock prices)

Chapter 3: Accounting and Finance

Financial reports: Provides general company information including letter from the CEO, Financial review, etc. Market participants pay a lot of attention to these reports and react quickly.

Book value (Accounting): Assets and liabilities presented at their historical cost (adjusted for depreciation). Backward-looking measures of value.

Market value (Finance): Current value of assets and liabilities. Forward-looking. Usually higher than book value. What shareholders care about, thus we will focus more on this.

The income statement – Key figures:

- Earnings before interest and taxes (EBIT)
  - EBIT = Total revenue – costs – depreciation
  - "Operating profit"
- Net Income (NI)
  - NI = EBIT – net interest expense – taxes
  - NI is either paid out as dividends or added to retained earnings
- *EBIT and NI <u>are accounting measures of profit</u>*

Profit vs. cashflows

- Profits:
  - Subtract depreciation (a non-cash expense)
  - Ignore cash expenditures on new capital (expense spread out over time in accounts)
  - Record income and expenses at the time of sales, not at time of cash exchange
  - Do not consider changes in working capital (return to in ch. 9)
- As we will see later, we are interested in cash flows when evaluating projects and/or firms
- Cash flows give correct timing and size of payments. Profits are just accounting

Topic 2: Interest rates & time value of money

Chapter 5: The time value of money

5.1 FUTURE VALUE AND COMPUNDED INTEREST

Value of money

Money is worth more today than in a year if:

- Interest rate is positive
- Inflation is positive
- Due to the risk factor (if you choose later you may not get it at all)

Calculating the future value of $100:

$$Future\ value\ (FV) = \$100 * (1 + r)^t$$

- **Interest** = Interest rate * initial investment
- **Value after one year** = initial investment * (1+r)
- **Compounded interest:** Interest earned on interest
- **Simple interest:** Interest earned only on the original investment; no interest earned on interest.

EXERCISE

	PV	**FV**	**R**	**T**
A	250	$FV = 250 * (1 + 0.1)^5 = \mathbf{402.6}$	10%	5
B	$PV = \frac{500}{(1 + 0.15)^{10}} = \mathbf{123.6}$	500	15%	10
C	650	2000	***5.78**	20
D	500	1250	5%	****18.78**

*Exercise C:

$$650 = \frac{2000}{(1 + r)^{20}}$$

$\Leftrightarrow$

$$\frac{2000}{650} = (1 + r)^{20}$$

$\Leftrightarrow$

$$\boldsymbol{r = \sqrt[t]{\frac{FV}{PV}} - 1}$$

**Exercise D:

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

$\Leftrightarrow$

$$\ln\left(\frac{FV}{PV}\right) = \ln(1 + r^t)$$

$\Leftrightarrow$

$$\ln\left(\frac{FV}{PV}\right) = \ln(1 + r) * t$$

$\Leftrightarrow$

$$\boldsymbol{t = \frac{\ln\left(\frac{FV}{PV}\right)}{\ln\,(1 + r)}}$$

5.2 PRESENT VALUES

Calculating the present value:

$$Present\ value\ (PV) = \frac{Future\ value\ after\ t\ periods}{(1 + r)^t}$$

Or if you need to save to a future payment:

$$Present\ value\ (PV) = \frac{Future\ payment}{(1+r)^t} = Future\ payment * \frac{1}{(1+r)^t}$$

Discounted cash flow (DCF): Method of calculating present value by discounting future cash flows.
Discount rate (r): Also known as the interest rate. Is used to compute present values of future cash flows.
Discount factor: Present value of a \$1 future payment: $\frac{1}{(1+r)^t}$

5.3 MULTIPLE CASH FLOWS

The present value of a stream of future cash flows is the amount you need to invest today to generate that stream. *E.g.:*

Year	Initial Balance	−	Payment	=	Remaining Balance	+	Interest Earned	=	Balance at Year-End
0	\$15,133.06		\$8,000		\$7,133.06		\$570.64		\$7,703.70
1	7,703.70		4,000		3,703.70		296.30		4,000.00
2	4,000.00		4,000		0		0		0

5.5 LEVEL CASH FLOWS: PERPETUITIES AND ANNUITIES

Annuity: Level stream of cash flows at regular intervals with a finite maturity.
Perpetuity: Stream of level cash payments that never ends.

How to value <u>perpetuities</u>

Cash payment from perpetuity = Interest rate * present value ⇔ $C = r * PV$
We can rearrange this relationship to derive the present value of a perpetuity, given the interest rate r and the cash payment C:

$$PV\ of\ perpetuity = \frac{C}{r} = \frac{cash\ payment}{interest\ rate}$$

C=Constant cash payments
r=interest rate

Delayed perpetuity:
To find today's value of the delayed perpetuity we need to multiply by a discount factor, say 3 years:

$$\frac{C}{r} * \frac{1}{(1+r)^t}$$

t=the period delayed

How to value <u>annuities</u>

If the interest rate is r, then the present value of an annuity that pays C dollars a year for each of t periods is:

$$PV\ of\ t-year\ annuity = C\left[\frac{1}{r} - \frac{1}{r(1+r)^t}\right]$$

The **annuity factor** is the present value of an annuity of $1 per period. Therefore, another way to write the value of an annuity is:

$$PV\ of\ t - year\ annuity = payment * annuity\ factor$$

The value of an annuity is equal to the difference between the value of the two perpetuities

	Cash Flow						
Year:	1	2	3	4	5	6 . . .	Present Value
1. Perpetuity A	$1	$1	$1	$1	$1	$1 . . .	$\frac{1}{r}$
2. Perpetuity B				$1	$1	$1 . . .	$\frac{1}{r(1+r)^3}$
3. Three-year annuity	$1	$1	$1				$\frac{1}{r} - \frac{1}{r(1+r)^3}$

Future value of annuities

How to calculate the FV:

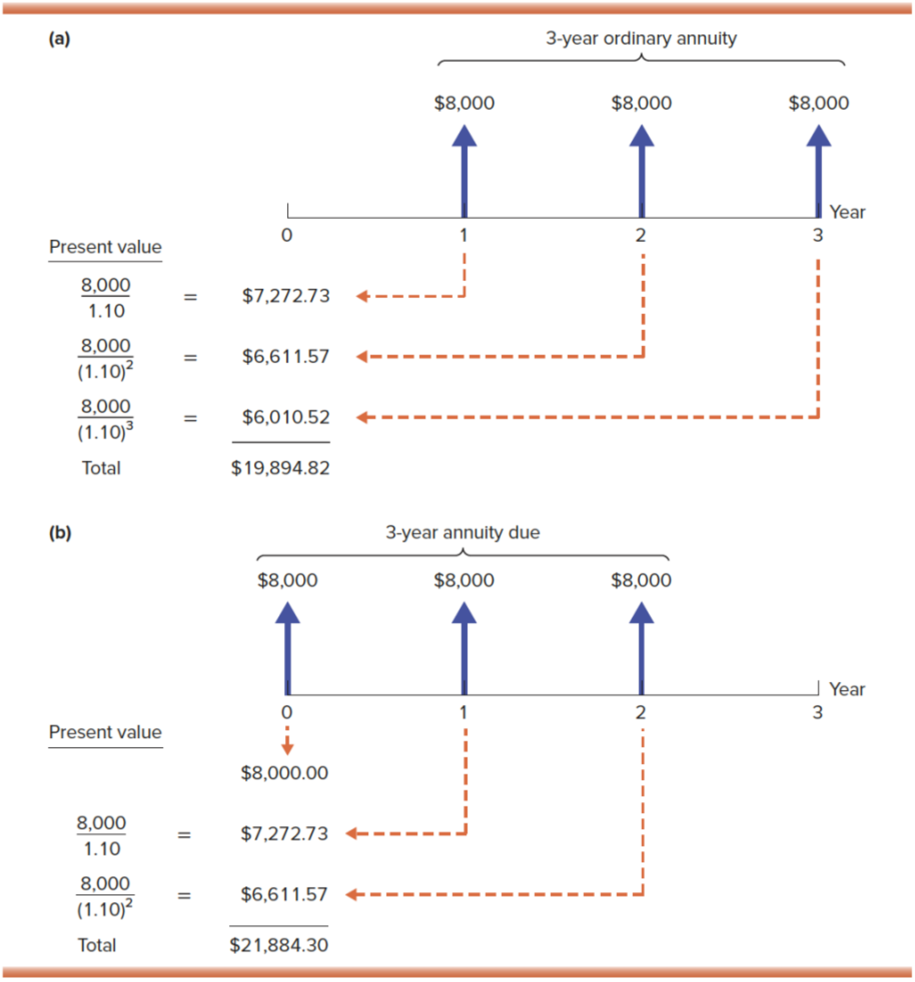
$$FV\ of\ annuity\ (Total) = PV\ of\ annuity\ (Total) * (1+r)^t$$

Annuities due

A level stream of payments starting immediately is known as an annuity due. The annuity will be due immediately instead of at the end of a period. It can be calculated as:

$$PV\ of\ annuity\ due = PV\ of\ ordinary\ annuity * (1+r)$$

Comparing it with an ordinary annuity:



5.7 EFFECTIVE ANNUAL INTEREST RATES

Effective annual interest rate (EAR)

Interest rate that is annualized using compound interest. The effective annual interest rate is defined as the rate at which your money grows, allowing for the effect of compounding.

E.g.: If a credit card company states that their monthly interest rate is 1% then the effective annual interest rate is:

$$1 + EAR = (1 + monthly\ rate)^{12} = 12.68\%$$

Annual percentage rate (APR): Interest rate that is annualized using simple interest. Sometimes required by law (e.g. in the US)

E.g.: The interest rate on your credit card loan was 1% per month. Because there are 12 months in a year, the APR on the loan is 12 × 1% = 12%

Example:
- What is the annual interest rate if the monthly interest rate is 1%?
  - APR = 1% x 12 = 12%
  - EAR = $(1+1\%)^{12}$ - 1=12.68%
- What is the monthly interest rate if the annual interest rate is 12%?
  - APR = Monthly x 12
    12% = Monthly x 12, so monthly int.rate will be 1%
  - 1+EAR = $(1+\text{Monthly})^{12}$
    1.12 = $(1+\text{Monthly})^{12}$
    $(1.12)^{1/12}$ = 1+ Monthly, so we get Monthly = 0.95%

5.8 INFLATION AND TIME VALUE OF MONEY

The increase in the general level of prices means that the purchasing power of money has eroded. Economists sometimes talk about current or nominal dollars versus constant or real dollars. Current or nominal dollars refer to the actual number of dollars of the day; constant or real dollars refer to the amount of purchasing power.

The nominal interest rate: The rate at which money invested grows.
The real rate of interest: Rate at which purchasing power of an investment increases. It takes inflation into account. It is calculated by:

$$1 + real\ interest\ rate = \frac{1 + nominal\ interest\ rate}{1 + inflation\ rate}$$

The real rate approximately equals the difference between the nominal rate and the inflation rate:

$$Real\ interest\ rate \approx nonimal\ interest\ rate - inflation\ rate$$

The approximation works best when both the inflation rate and the real rate are small. When they are not small, throw the approximation away and do it right.

Nominal cash flow: Measured in current time prices. C_t: The actual amount of money received or paid at time t.
Real cash flow: Measured in constant prices, i.e. every payment is in prices of a specific time t (measured in purchasing power of the base year). c_t: the amount of money received (or paid) at time t after removing the effect of inflation.

$$c_t = \frac{C_t}{(1+\pi)^t} \Rightarrow C_t = c_t * (1+\pi)^t$$

NOTE: Current dollar cash flows must be discounted by the nominal interest rate; real cash flows must be discounted by the real interest rate.

Topic 3: Valuing bonds and stocks

Chapter 6: Valuing bonds

6.1 THE BOND MARKET

Bond characteristics:

- Bond: Security that obligates the issuer to make specified payments to the bondholder

- Face value: Payment at the maturity of the bond. Also called principal or par value
- Coupon: The interest payments paid to the bondholder
- Bid price: What the bond holder will receive for its bond
- Asked yield to maturity: Measures the return to investors if they buy the bond at the asked price and hold it to maturity
- Bond types:
    - Bullet bond: Face value paid at maturity, and interest paid during the life of the bond
    - Serial bond: The repayments of the face value is distributed evenly over each payment (typical mortgage bond)
    - Annuity bond: All payments are the same. The repayment of the face value and the interest payment for each payment date are determined accordingly

EXERCISE

	Bullet bond			Serial bond			Annuity bond		
Time	Interest	Total payment	Remai. f.value	Interest	Total payment	Remai. f.value	Interest	Total payment	Remai. f.value
0			100.00			100.00			100.00
1	10.00	10.00	100.00	10.00	35.00	75.00			78.45
2				7.50			7.85		
3	10.00	10.00	100.00		30.00	25.00			28.68
4			0.00	2.50	27.50	0.00	2.87		0.00

Bullet bond	Serial bond	Annuity bond
1. 10, 10, 100 2. 10, 110	1. 32.5, 50 2. 5	1. 10, 31.55 2. 31.55, 54.75 3. 5.475, 31.55 4. 31.55

6.2 INTEREST RATES AND BOND PRICES

If you need to value a bond with many years to run before maturity, it is usually easiest to value the coupon payments as an annuity and then add on the present value of the final payment:

$$PV = (coupon\ or\ interest * annuity\ factor) + (face\ value * discount\ factor)$$

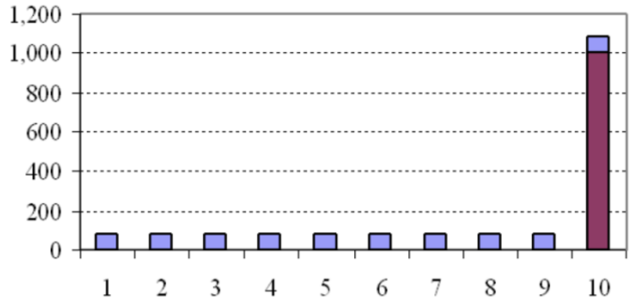
⇔

$$PV = cpn\left[\frac{1}{r} - \frac{1}{r(1+r)^t}\right] + \frac{face\ value_t}{(1+r)^t}$$

Example:

$$12.5 * \left[\frac{1}{0.01194} - \frac{1}{0.01194(1+0.01194)^3}\right] + 1{,}000 * \frac{1}{1.01196^3} = \$1{,}001.64$$

Bullet bond:

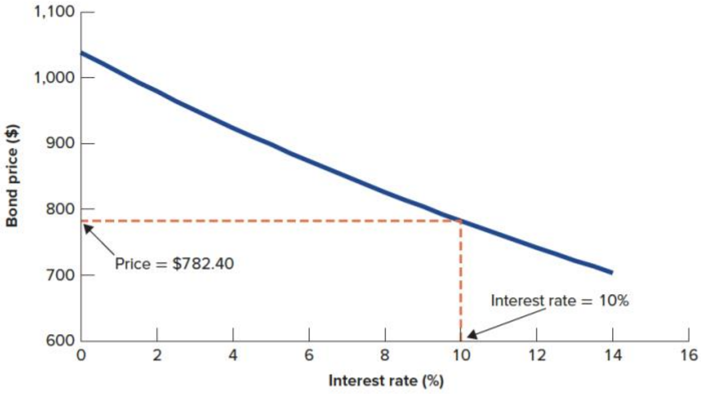


NOTE: the coupon rate is not the discount rate.

Interest rates and bond prices

- When the interest rate is the same as the coupon rate, the bond sells for the same value
- When the interest rate is lower than the coupon rate, the bond sells for higher than its face value → It is sold for a premium
- When the interest rate is higher than the coupon rate, the bond sells for lower than its face value → It is sold at a discount

The value of the 1.25% bond falls as interest rise:



Interest rate risk: The risk in bond prices due to fluctuations in interest rates. A change in interest rates has only a modest impact on the present value of near-term cash flows but a much greater impact on the value of distant cash flows

6.3 YIELD TO MATURITY

Current yield: Annual coupon payment divided by the bond price (e.g.: $100 in interest a year and you paid $1200 for then bond, then the current yield is: $100/$1200=8.3%)

Yield to maturity: The discount rate at which the present value of the bond's payments equals the price. This is if you hold to bond to its maturity. It can be calculated only through trial and error *(no specific formula but you can solve for r).* We will not be asked to calculate this in the exam. E.g.:

$$\text{PV at } 10\% = \frac{\$100}{(1.10)} + \frac{\$100}{(1.10)^2} + \frac{\$1{,}100}{(1.10)^3} = \$1{,}000.00$$

$$\text{PV at } 2.94\% = \frac{\$100}{(1.0294)} + \frac{\$100}{(1.0294)^2} + \frac{\$1{,}100}{(1.0294)^3} = \$1{,}200$$

6.4 BOND RATES OF RETURN

As interest rates fluctuate, the return that you earn in the interim may be very different from the yield to maturity. If interest rates rise in a particular period, the price of your bond will fall and your return for that period will be lower than the yield to maturity. Conversely, if rates fall, the price of your bond will rise and your return will be higher.

Rate of return: Can be calculated as:

$$ROR = \frac{coupon\ income + price\ change}{investment}$$

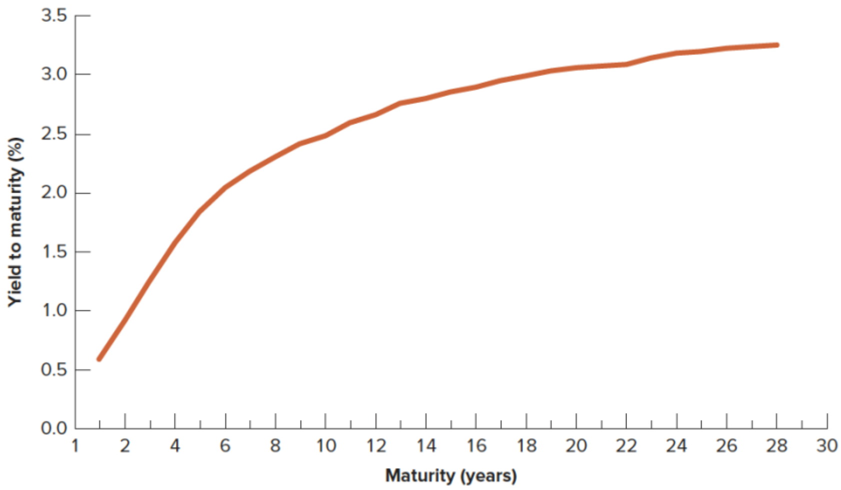
Connection with yield to maturity: If the bond's yield to maturity remains unchanged during the period, the bond price changes with time so that the total return on the bond is equal to the yield to maturity. The rate of return will be less than the yield to maturity if interest rates rise, and it will be greater than the yield to maturity if interest rates fall.

How bond prices change as they approach maturity, assuming an unchanged yield to maturity of 4%. Prices of both premium and discount bonds approach face value as their maturity date approaches.

6.5 THE YIELD CURVE

The yield curve: Plot of relationship between bond yields to maturity and time to maturity.

- The longer the maturity the higher the yield. However, there are two things that make long-term bonds unattractive:
  - The prices of long-term bonds fluctuate much more than prices of short-term bonds.
  - Short-term investors can profit if the interest rates rise. Suppose you hold a 1-year dons. A year from now, when the bond matures, you can reinvest the proceeds and enjoy whatever rates the bond markets offer then.



Strips: Treasury strips are bonds that make a single payment. The yields on Treasury strips in November 2015 show that investors received a higher yield to maturity on longer-term bonds.

6.6 CORPORATE BONDS AND THE RISK OF DEFAULT

Default risk: The additional yield on a bond that investors require for bearing credit risk.
Default premium: The difference between the promised yield on a corporate bond and the yield on a U.S. Treasury bond with the same coupon and maturity is called the default premium. Risk premium for buying corporate bond instead of government bond.

- Example:

A 5.5%, 3 year corporate bond is trading at 980.13, which gives a YTM of 6.25%

A 5.5% 3 year goverment bond is trading at 1056.03, which gives a YTM of 3.50%

Thereby, the credit spread will be 6.25% - 3.50% = 2.75%

Investment grade: Bonds rated Baa or above by Moody's or BBB or above by Standard & Poor's or Fitch.
High yield/junk bonds: Bonds with a rating below Baa/BBB.

Protecting against default risk

Bondholders can never eliminate default risk, but they can take steps to minimize it

- Seniority: Some debts are subordinated. In the event of default, the subordinate lender gets in line behind the firm's general creditors. The subordinated lender holds a junior claim and is paid only after all senior creditors are satisfied. Therefore, investors who want to limit their risk will hold senior claims.
- Security: Debt that, in the event of a default, has first claim on specified assets.
- Protective covenants: Conditions imposed on borrowers to protect lenders from unreasonable risks.

Chapter 7: Valuing stocks

7.1 STOCKS AND THE STOCK MARKET

- Common stock: Ownership shares in a publicly held corporation
- IPO: First offering of stock to general public
- Primary offering: The corporation sells shares in the firm
- Primary market: Marker for the sale of new securities by corporations

- Secondary market: Market in which previously issued securities are traded among investors
- Dividend yield: How much dividend income you would receive for every $100 invested in the stock

7.2 MARKET VALUES, BOOK VALUES AND LIQUIDATION VALUES

- Book value: Net worth of the firm according to their balance sheet. However, investors do not just buy and sell at book value per share.
- Liquidation value: The amount of cash per share a company could raise if it sold off all its assets in secondhand markets and paid off all its debts.
- Market value is the amount that investors are willing to pay for the shares of the firm. This depends on the earning power of today's assets and the expected profitability of future investments.

	Ticker	Stock Price	Book Value per Share	Market-to-Book-Value Ratio
FedEx	FDX	$161.50	$54.12	3.0
Johnson & Johnson	JNJ	101.45	25.96	3.9
Campbell Soup	CPB	48.30	4.45	10.9
PepsiCo	PEP	98.83	9.31	10.6
Walmart	WMT	58.68	24.53	2.4
Dow Chemical	DOW	51.71	17.55	2.9
Amazon	AMZN	659.68	26.50	24.9
McDonald's	MCD	112.93	9.05	12.5
American Electric Power	AEP	55.10	36.06	1.5
General Electric	GE	30.12	11.00	2.7

Going-concern value

The difference between a company's actual value and its book or liquidation value is often attributed to going-concern value, which refers to three factors:

1. Extra earning power: A company may have the ability to earn more than an adequate rate of return on assets
2. Intangible assets: There are many assets that accountants don't put on the balance sheet. Some of these assets are extremely valuable. For instance, expertise, experience and knowledge are crucial assets
3. Value of future investments: If investors believe in a company will have the opportunity to make very profitable investments in the future, they will pay more for the company's stock today.

7.2 VALUING COMMON STOCKS

Valuation by comparables

When financial analysts need to value a business, they often start by identifying a sample of similar firms. They then examine how much investors in these companies are prepared to pay for each dollar of assets or earnings.

Price and intrinsic value

Intrinsic value (V_0): Present value of future cash payoffs from a stock or other security. You can think of the intrinsic value as the "fair" price for the stock. The present value of the cash flows the investor will receive is:

$$V_0 = \frac{DIV_1 + P_1}{1 + r}$$

- P_1*: Predicted stock price in one year*
- DIV_1*: The expected dividend per share*
- r*: The discount rate (The discount rate reflects the risk of the stock. Riskier firms will have higher discount rates)*

Expected return

The expected dividend plus the expected increase in price, P1 − P0, all divided by price at the start of the year, P0:

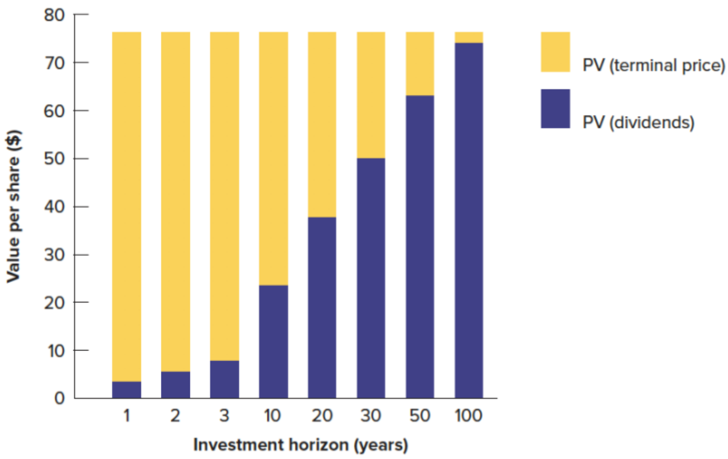
$$Expected\ return = \frac{DIV_1 + P_1 - P_0}{P_0} = \underbrace{\frac{Div_1}{P_0}}_{Div.yield} + \underbrace{\frac{P_1 - P_0}{P_0}}_{Capital\ gain}$$

The dividend discount model:

Discounted cash-flow model that states that today's stock price equals the present value of all expected future dividends. In words, the value of a stock is the present value of the dividends it will pay over the investor's horizon plus the present value of the expected stock price at the end of that horizon (H):

$$P_0 = \frac{DIV_1}{(1+r)^r} \ldots + \frac{DIV_H + P_H}{(1+r)^H}$$

Note that total present value does not depend on the investment horizon



If the horizon is infinitely far away, then we can forget about the final horizon price—it has almost no present value—and simply say:

$$Stock\ price = PV(all\ future\ dividends\ per\ share)$$

7.4 SIMPLIFUING THE DIVIDEND DISCOUNT MODEL

The dividend discount model with no growth

If a company pays out all of its earnings to its shareholders, it does not grow. To calculate the stock value:

$$P_0 = \frac{EPS_1}{r}$$

With EPS representing the next year's earnings per share of stock.

The dividend discount model with constant growth

Suppose that a stock is expected to pay a dividend of DIV1 next year, and thereafter, the dividend is expected to grow each year by the rate g. The value of the stock is therefore:

$$P_0 = \frac{DIV_1}{r - g}$$

This equation is called *the constant-growth dividend discount model.*

- Sustainable growth ratio: The firm's growth rate if it plows back a constant fraction of earnings, maintains a constant return on equity, and keeps its debt ratio constant.
- Payout ratio: Fractions of earnings paid out as dividends.
- Plowback ratio: Fraction of earnings retained by the firm.
- PVG: Present value of growth opportunities. The present value of a firm's expected future investments

The dividend discount model with nonconstant growth

Is calculated using three steps: (i) Set the investment horizon h, (ii) Forecast the stock price at the horizon, and discount it also to give its present value today, and (iii) sum the total present value of dividends plus the present value of the ending stock price:

$$P_0 = \underbrace{\frac{\text{DIV}_1}{1+r} + \frac{\text{DIV}_2}{(1+r)^2} + \cdots + \frac{\text{DIV}_H}{(1+r)^H}}_{\text{PV of dividends from year 1 to horizon}} + \underbrace{\frac{P_H}{(1+r)^H}}_{\text{PV of stock price at horizon}}$$

Determining g (the growth rate):

If a company earns a constant return on equity and plows back a constant proportion of earnings, then its growth rate, g, is

$$g = sustainable\ growth\ rate = ROE * plowback\ ratio$$

Why?

If a firm pays out all its earnings, then a shareholder's return on his ownership is as follows:

$$ROE = \frac{earning\ per\ share}{equity\ per\ share}$$

Multiply both sides by the plowback ratio:

$$ROE * plowback\ ratio = \frac{earning\ per\ share * plowback\ ratio}{equity\ per\ share}$$

7.5 VALUING A BUSINESS BY DISCOUNTED CASH FLOW

Free cash flow: Cash flow available for distribution to investors after firm pays for new investments or additions to working capital (all investments needed to grow). free cash flow can be zero or negative for rapidly growing businesses.

Valuing business

The value of a business is usually computed as the discounted value of free cash flows out to a valuation horizon (H), plus the forecasted value of the business at the horizon, also discounted back to present value. That is:

$$PV = \underbrace{\frac{FCF_1}{1+r} + \frac{FCF_2}{(1+r)^2} + \cdots + \frac{FCF_H}{(1+r)^H}}_{\text{PV(free cash flow)}} + \underbrace{\frac{PV_H}{(1+r)^H}}_{\text{PV(horizon value)}}$$

PV_H stands in for the total present value of the project's free cash flows in period H1 + H2 and so on (Valuation horizons are often chosen arbitrarily. Sometimes the boss tells everybody to use 10 years because that's a round number).

7.6 MARKET EFFECIENCIES
Efficient market hypothesis (EMH)
- The hypothesis states that stock prices reflect available and relevant information
- In such a market all regular investors have the same amount of information
- Creates credibility and trust on the market

Also, a market is efficient if it reacts on average…
...fast to new information (new info immediately reflected in price)
...sensibly to new information given its nature (positive, negative)
...only to new and unpublished information
...only to relevant and non-neutral information

Implication: No free lunch: you have no more information than others and you cannot act faster on new information than the market (cannot beat the market!)

7.7 MARKET ANOMALIES AND BEHAVIORAL FINANCE
- The momentum factor: researchers who have looked at stock market returns over long periods have found a tendency for price rises to persist for some 6 to 9 months and then to revert.
- The new-issues puzzle: Early gains from IPOs turn often turn into losses.
- Bubbles: every now and again investors seem to be caught up in a speculative frenzy, and asset prices then reach levels that (at least with hindsight) cannot easily be justified by the outlook for profits and dividends.

Topic 4: Investment criteria

Chapter 8: Net present value and other investment criteria

8.1 NET PRESENT VALUE
The present value is the only feasible price, and the present value of the property is also its market price or market value.
- Net present value (NPV): Present value of cash flows minus investment. All payments can be either positive or negative.
$$NPV = PV - required\ investment$$
- Opportunity cost of capital: Expected rate of return given up by investing in a project rather than in the capital market.

Valuing long-lived projects

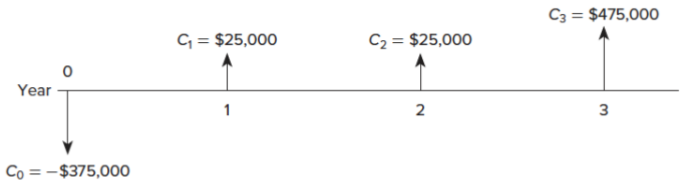
C_0 denotes the initial cash outflow investment and the discount rate, r, denotes the opportunity cost of capital.

$$NPV = C_0 + \frac{C_1}{1+r} + \frac{C_2}{1+r} + \frac{C_3}{1+r}$$

Or for longer periods:

$$NPV = C_0 + C\left[\frac{1}{r} - \frac{1}{r(1+r)^H}\right]$$

E.g.:



When choosing between mutually exclusive projects, choose the one that offers the highest net present value. Other criteria will typically not overrule the decision from NPV.

8.2 THE INTERNAL RATE OF RETURN RULE

In a one-year project you can compute end-of year profit per dollar invested in the project:

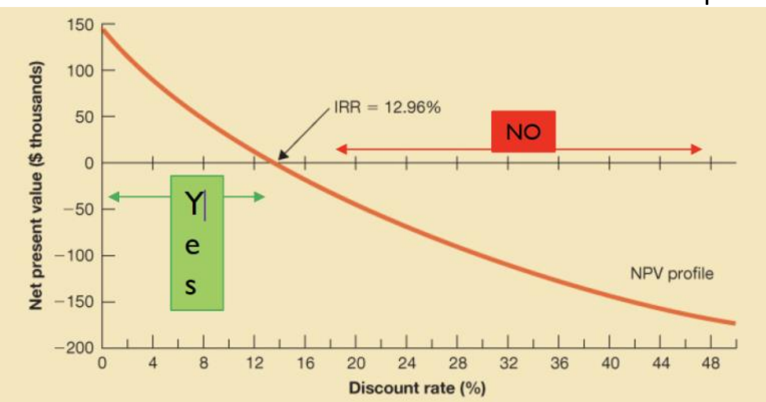
$$Rate\ of\ return = \frac{profit}{investment} = \frac{C_1 - investment}{investment} = \frac{400{,}000 - 350{,}000}{350{,}000} = 14.3\%$$

This now gives us two rules we can use:

1. The NPV rule: Invest in any project that has a positive NPV when its cash flows are discounted at the opportunity cost of capital.
2. The rate of return rule: Invest in any project offering a rate of return that is higher than the opportunity cost of capital (NOTE: several limitations to this. See page 249)

NPV and rate of return

The rate of return is the discount rate at which NPV equals zero.



If the opportunity cost of capital is less than the project rate of return, then the NPV of your project is positive. If the cost of capital is greater than the project rate of return, then NPV is negative.

IRR – Rate of return on more than one payoff

The discount rate that gives the project a zero NPV is known as the project's internal rate of return, or IRR. It is also called the discounted cash-flow (DCF) rate of return.

$$0 = C_0 + \frac{C_1}{(1+IRR)^1} + \frac{C_2}{(1+IRR)^2} + \ldots + \frac{C_t}{(1+IRR)^t}$$

$$-C_0 = \frac{C_1}{(1+IRR)^1} + \frac{C_2}{(1+IRR)^2} + \ldots + \frac{C_t}{(1+IRR)^t}$$

- IRR is the discount rate at which NPV equals zero
- Projects that earn a good rate of return for a long time often have higher NPVs than those that offer high percentage rates of return but die young
- When NPV rises as the interest rate rises, the rate of return rule is reversed (remember to check for this)
- *There is no simple general method for solving this equation to find the IRR*
- NOTE: Always remember to compute NPV as well!

IRR example
You purchase a building for $350,000.
The investment will generate $16,000 in cash flows during the first three years.
At the end of year three you will sell the building for $450,000.
The IRR is:

$$0 = -350{,}000 + \frac{16{,}000}{(1+IRR)^1} + \frac{16{,}000}{(1+IRR)^2} + \frac{466{,}000}{(1+IRR)^3}$$

IRR = 12.961%

8.3 THE PROFITABILITY INDEX
The profitability index measures the net present value of a project per dollar of investment:

$$Profitability\ index = \frac{net\ present\ value}{initial\ investment}$$

E.g.: For example, our initial proposal to construct an office building involved an investment of $350,000 and had an NPV of $23,832. Its profitability index was:

$$\frac{23{,}832}{350{,}000} = 6.8\%$$

Also known as the benefit-cost ratio. The index measures the benefit realized per dollar of cost. Is good to calculate if the firm is short on money (capital rationing) and need a project that gives a "big-bang".

- Benefit: of the project is its net present value.
- Cost: is the required investment.

Profitability index rule: Accept project if profitability index is greater than 0. In case of capital rationing, accept projects with highest profitability index.

8.4 THE PAYBACK RULE

- A project's payback period is the length of time before you recover your initial investment.
- The payback rule states that a project should be accepted if its payback period is less than a specified cutoff period.

Project	Cash Flows (dollars) C_0	C_1	C_2	C_3	Payback Period (years)	NPV at 10%
F	−2,000	+1,000	+1,000	+10,000	2	$7,249
G	−2,000	+1,000	+1,000	0	2	−264
H	−2,000	0	+2,000	0	2	−347

Looks at the number of periods before the discounted cash flows recover the initial investment. Again, remember to calculate NPV.

Disadvantages
- Cash flows beyond the payback period are not considered
- Ignores the opportunity cost (Other investment opportunities)
- Projects with same payback may have quite different NPV

Advantages
- Simple
- Gives an easy overview of when money is earned

8.5 MORE MUTUALLY EXCLUSIVE PROJECTS
Problems when choosing investment projects
1. The timing of the investment: You can either proceed with the project now or do so later. The decision rule for investment timing is to choose the investment date that produces the highest net present value today
2. The choice between long- and short-lived equipment: We thus have a rule for comparing assets with different lives: Select the machine that has the lowest equivalent annual annuity (The cash flow per period with the same present value as the cost of buying and operating a machine).

$$Equivalent\ annual\ annuity = \frac{present\ value\ of\ costs}{annuity\ factor}$$

3. When to replace and old machine:

8.6 AN OVERVIEW
TABLE 8.2 A comparison of investment decision rules

Criterion	Definition	Investment Rule	Comments
Net present value (NPV)	Present value of cash flows minus initial investment	Accept project if NPV is positive. For mutually exclusive projects, choose the one with the highest (positive) NPV.	The "gold standard" of investment criteria. Only criterion necessarily consistent with maximizing the value of the firm. Provides appropriate rule for choosing between mutually exclusive investments. Only pitfall involves capital rationing, when one cannot accept all positive-NPV projects.
Internal rate of return (IRR)	The discount rate at which project NPV equals zero	Accept project if IRR is greater than opportunity cost of capital.	If used properly, results in same accept-reject decision as NPV in the absence of project interactions. However, beware of the following pitfalls: IRR cannot rank mutually exclusive projects—the project with higher IRR may have lower NPV. The simple IRR rule cannot be used in cases of multiple IRRs or an upward-sloping NPV profile.
Profitability index	Ratio of net present value to initial investment	Accept project if profitability index is greater than 0. In case of capital rationing, accept projects with highest profitability index.	Results in same accept-reject decision as NPV in the absence of project interactions. Useful for ranking projects in case of capital rationing, but misleading in the presence of interactions. Cannot rank mutually exclusive projects.
Payback period	Time until the sum of project cash flows equals the initial investment	Accept project if payback period is less than some specified number of years.	A quick and dirty rule of thumb, with several critical pitfalls. Ignores cash flows beyond the acceptable payback period. Ignores discounting. Tends to improperly reject long-lived projects.

Chapter 9: Using discounted cash-flow analysis to make investment decisions

What should you discount? Identifying and calculating the cash flows.

8.1 IDENTIFYDING CASH FLOWS

1. **Cash flows – not profits**

When calculating NPV, recognize investment expenditures when they occur, not later when they show up as depreciation. Cash flows – and the timing of these – is what matters. Not the profits determined by accounting.

2. **Incremental cash flows**

A project's PV depends on the extra CF that it produces.

Incremental Cash Flow = cash flow with project - cash flow without project

In particular (page 278),

- Include all indirect effects: A new project may help or harm the firm's existing business. These indirect effects must be taken into account.
- Forget sunk costs: Sunk costs remain the same whether or not you accept the project. Therefore, they do not affect project NPV
- Include opportunity costs: Even though there is no out-of-pocket cost, there is an opportunity cost, that is, the value of a forgone alternative.
- Recognize the investment in working capital (current assets minus current liabilities): Investments in working capital, just like investments in plant and equipment, result in cash outflows
- Remember shutdown cash flows: The end of a project always brings additional cash flows, both costs and revenue.
- Beware of allocated overhead costs (utility bills, and the like that come in extra due to the project)

3. **Taking account of inflation**

(already done this)

4. **Separate investment decision from financing**

First, check whether project is worth undergoing (NPV).
Second, if viable, undertake a separate analysis of the best financing strategy.

9.2 CALCULATING CASH FLOWS

Cash flows are composed of three elements:

- *Total cash flow =*

    Cash flow from capital investments (Fixed capital)
    + cash flow from investment in working capital (Short-term assets and liabilities. The things you need to keep your business going)
    + cash flow from operations (Three methods to calculate this)

Investment in working capital

An increase in working capital is an investment and therefore implies a negative cash flow; a decrease in working capital implies a positive cash flow. The cash flow is measured by the change in working capital, not the level of working capital

	Revenues
-	Costs
-	Depreciation
=	Profit before taxes
-	Taxes
=	Profit after taxes
+	Depreciation
±	Inv. in fixed capital
±	Inv. in working cap.
=	Cash flow

Operating cash flows

1. Dollars-in minus dollars out
    a. Operating cash flow = revenues – cash expenses – taxes
2. Adjusted accounting profits
    a. Operating cash flow = after tax profit + depreciation
3. Add back depreciation tax shield
    a. Skip (exact treatment depends on country)

Example

Example: Find operating cash flow from the following income statement:

Revenues	1,000
– Expenses	600
– Depreciation	200
= Profit before tax	200
– 35% tax	70
= Net profit	130

- Operating cash flow = revenues – cash expenses – taxes
  = 1000 – 600 – 70 =330
- Operating cash flow = after tax profit + depreciation
  = 130 + 200 = 330

Salvage value

When you sell equipment, you must pay taxes on the difference between the sales price and the book value of the asset.

E.g. Machine bought for $5,0000 and depreciated with $2,000 for two years. Tax rate = 30%

- *Scenario 1: Sold for $2,000 in year three: Profit of $1,000. Deduct $300 from operating cash flow.*
- *Scenario 2: Sold for $100 in year three: Loss of $900. Add $270 to the operating cash flow.*

Chapter 10: Project analysis

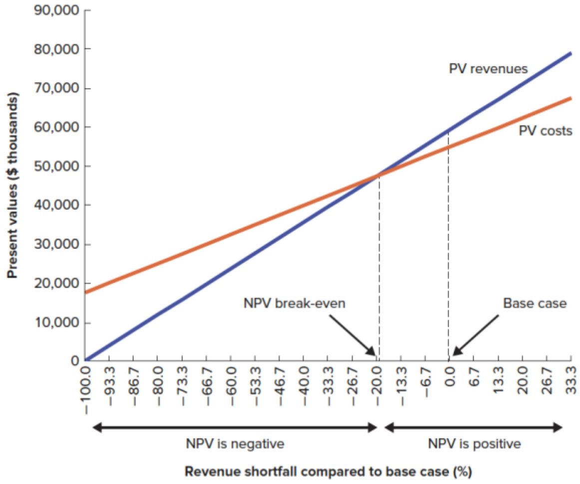
10.3 SOME "WHAT-IF" QUESTIONS

Sometimes you need a more in-depth analysis of investment projects since forecasts are just estimates. This can be done by:

- Sensitivity analysis
    - Analysis of the effects on project profitability of changes in sales, costs, and so on.
    - What will NPV be for many different values of an input variable

Variable	Possible Annual Deviation from Expected Values		NPV (thousands of dollars)		
	Pessimistic	Optimistic	Pessimistic	Expected	Optimistic
Investment	+35%	−25%	+$1,606	+$4,223	+$6,092
Revenues	−20	+15	−91	+4,223	+7,458
Variable costs	+30	−25	−515	+4,223	+8,170
Fixed costs	+40	−25	+11	+4,223	+6,855
Working capital	+100	−50	+2,458	+4,223	+5,105

- Scenario analysis
  - What will NPV be for different combinations of the input variables
  - Typically: worst case, expected case, best case
- Break-even analysis
  - NPV break-even point: Minimum level of sales needed to cover all costs including the cost of capital
  - Both simply asking how robust/reliable/volatile our calculations are



We use our best estimate of input variables when calculating NPV, but we are often uncertain about the exact values

Operating leverage

Risk varies with operating leverage (degree to which costs are fixed). If a large proportion of costs is fixed, a shortfall in sales has a magnified effect on profits.

- DOL (Degree of operating leverage): Percentage change in profits given a 1% change in sales:

$$DOL = \frac{percentage\ change\ in\ profits}{percentage\ change\ in\ sales}$$

EXAMPLE

Break-even analysis

How much do our assumptions need to change such that our calculations turn our investment decision?

- How much does an input variable need to change in order for NPV to change signs?

Find value of input variable that makes NPV=0

- Any scenario worse than that will make project undesirable

Simple example:

- You buy a painting today for $1000 that you are going to resell at the end of the year. Assuming your opportunity cost of capital is 10%, what is the sale price which would make you break-even?

$$0 = -1000 + \frac{\text{Repayment}}{(1+0.10)}$$

- Anything above 1100 makes the NPV of the project positive

Topic 5: Risk and return

Chapter 11: Introduction to risk, return, and the opportunity cost of capital

11.1 RATES OF RETURN: A REVIEW

The percentage return on your investment:

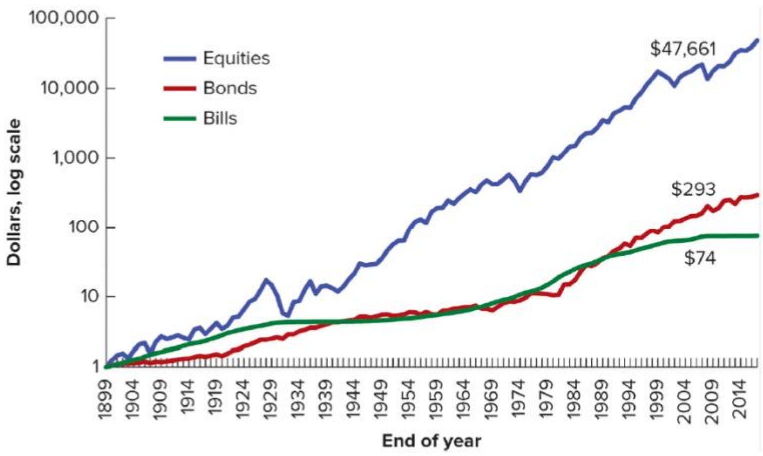
$$Percentage\ return = \frac{capital\ gain\ (gain\ or\ loss\ from\ selling) + dividends}{initial\ share\ price}$$

11.2 A CENTURY OF CAPITAL MARKET HISTORY

Measuring market return – Market indexes

- Dow Jones Industrial Average (The Dow)
  - Value of a portfolio holding one share in each of 30 large industrial firms
- Standard & Poor's Composite Index (S&P 500)
  - Value of a portfolio holding shares in 500 firms. Some firms in this index weigh more than others due to their market size
- Financial times stock exchange index (FTSE) - UK
- C20
  - Index based on 20 most traded shares listed at Nasdaq-Copenhagen

Historical return: Growth of $1 invested in 1900 (see picture to the right)



Risk premium:

Average extra return relative to T-bills. The compensation for taking on risk.

Risk premium is important to determine expected market return.

	Expected market return	=	Int. rate on Treasury bills	+	Normal risk premium
1981:	21.7%	=	14	+	7.7
2008:	9.9%	=	2.2	+	7.7
2018:	9.4%	=	1.7	+	7.7

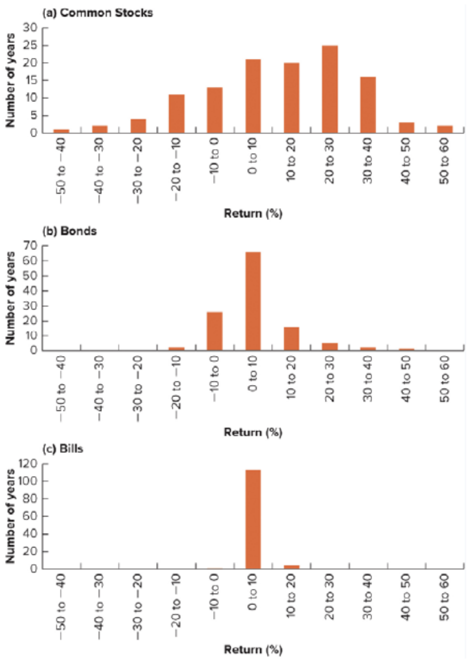
Risk premium differs across countries. It can be hard to determine why, but it's is often justified why (maybe due to historical data, investor types, legal environment, etc.).
Risk premium can be calculated by:

$$Rate\ of\ return\ on\ common\ stocks = interest\ rate\ on\ T - bills + market\ risk\ premium$$

11.3 MEASURING RISK

Historical distribution of returns

- Returns are relatively volatile for stocks. Returns differ significantly from the mean return
- A risk measure should capture this phenomenon.



The financial managers need a numerical measure of dispersion to quantify risk. The standard measures are variance and standard deviation.

Variance

- A measure of volatility
- Average value of squared deviations from mean
- Equivalent to expected value of squared deviations from mean

$$Variance\ (r) = \sigma^2 = Expected\ value\ of\ (r - \bar{r})^2 = \frac{\sum_{i=1}^{N}(r_i - \bar{r})^2}{N}$$

The idea:

- Want an estimate of how far tomorrow's return may be from history's return
- To get this estimate, find the average of this difference for days in the past

Standard deviation
Also a measure of volatility. The square root of the variance:

$$St.dev\,(r) = \sqrt{variance(r)} = \sqrt{\sigma^2} = \sigma$$

Note: St.dev is typically reported on annual basis, meaning:

$$Stdev_{Annual} = Stdev_{Weekly} \cdot \sqrt{52}$$
$$Stdev_{Annual} = Stdev_{Daily} \cdot \sqrt{252}$$

Rules-of-thumb interpretation

- One out of every 3 outcomes will be more than 1 standard deviation away from the mean
- One out of every 20 outcomes will be more than 2 standard deviations away from the mean

Measuring the variation in stock returns
When estimating the spread of possible outcomes from investing in the stock market, most financial analysts start by assuming that the spread of returns in the past is a reasonable indication of what could happen in the future. Therefore, they calculate the standard deviation of past returns.

Year	Rate of Return (%)	Deviation from Average Return (%)	Squared Deviation
2010	17.86	5.39	29.02
2011	−0.90	−13.37	178.85
2012	15.97	3.50	12.23
2013	31.71	19.24	370.05
2014	10.86	−1.61	2.60
2015	−0.66	−13.13	172.48
Total	74.84		765.23
Average return = 74.84/6 = 12.47%			
Variance = average of squared deviations = 765.23/6 = 127.54			
Standard deviation = square root of variance = 11.29%			

11.4 RISK AND DIVERSIFICATION
Observation:
The standard deviation of returns for individual firms are generally (much) higher than the standard deviation for the market return.
This is due to diversification:

- Stock returns are volatile since the firm has its up's and down's.
- The market return is the combined return of all stocks on the market (or the specific market index)
- When some firms do poorly, others do well – this partly cancels out and thus the market return is more stable over time than individual stocks

Expected return (Average return)

$$Expected\ return = Return\ in\ each\ scenario * Prob.of\ scenario$$

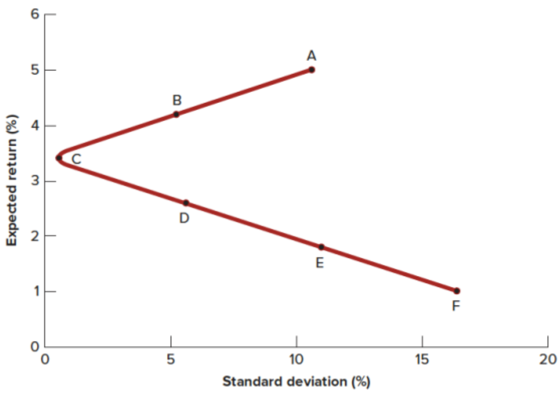
Portfolio rate of return

The portfolio return for each day if you invest equally in two assets:

$$\text{Portfolio rate of return} = \left(\text{fraction of portfolio in first asset} \times \text{rate of return on first asset}\right) + \left(\text{fraction of portfolio in second asset} \times \text{rate of return on second asset}\right)$$

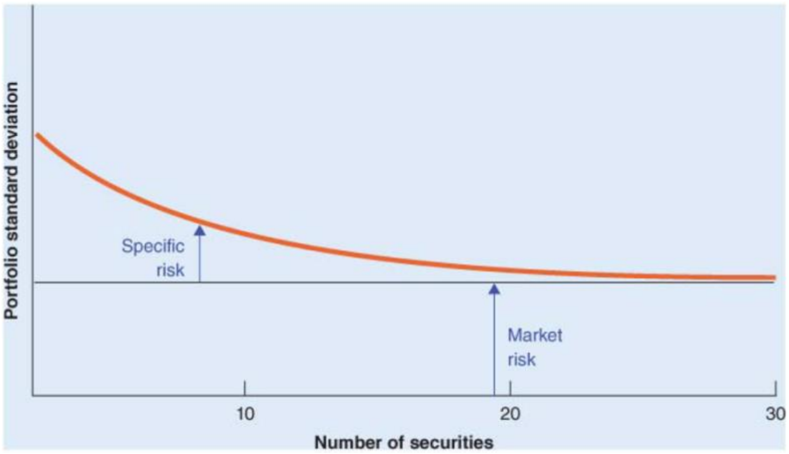
Portfolio rate of return and volatility can vary very much when you play with the fraction. Look at auto stocks and gold stocks (countercyclical), when changing the weights in the portfolio:

	Portfolio Weights		Portfolio Rate of Return (%)			Expected Return	Standard Deviation
	Gold	Autos	Recession	Normal	Boom		
A	0.0	1.0	−8.0	5.0	18.0	5.0	10.6
B	0.2	0.8	−2.4	4.6	10.4	4.2	5.2
C	0.4	0.6	3.2	4.2	2.8	3.4	0.6
D	0.6	0.4	8.8	3.8	−4.8	2.6	5.6
E	0.8	0.2	14.4	3.4	−12.4	1.8	11.0
F	1.0	0.0	20.0	3.0	−20.0	1.0	16.4



The **investment opportunity frontier** shows the benefit of diversification. Each point on the curve represents a feasible combination of expected return and volatility.

Diversification
Strategy designed to reduce risk by spreading the portfolio across many investments. However, as the figure shows, no matter how many securities you hold, you cannot eliminate all risk.



Unique risk (specific risk)
Risk factors affecting only that firm. Also called "diversifiable risk". This can be eliminated by diversification.

Market risk
Economy-wide risk (macroeconomic) sources of risk that affect the overall stock market. Also called "systematic risk". You cannot avoid this risk, no matter how much you diversify.

Topic 6: CAPM

Chapter 12: Risk, return and capital budgeting

12.1 MEASURING MARKET RISK

Market portfolio
Portfolio of all assets in the economy. In practice a broad stock market index is used to represent the market.

Beta
A measure of market risk. How a stock moves relative to the market.

$$\beta = \frac{Market\ return}{Return\ on\ firm\ stock}$$

OR

$$\beta = \frac{\Delta stock}{\Delta market}$$

OR

$$\beta = \frac{Bust_{stock} - Boom_{stock}}{Bust_{market} - Boom_{market}}$$

- Sensitivity of a stock's return to the return on the market portfolio
- High beta stocks ($\beta > 1$) respond more to market changes
    - I.e. it is more volatile than the market portfolio with a beta of 1.
- Low beta stocks ($\beta < 1$) respond less to market changes
    - *E.g.: If a firm has a beta of 1.26, then when the market moves by 1%, the stock will move by 1.26%*

How to calculate the beta

Observe rates of return, usually monthly or weekly, for the stock and the market → Plot the observations → Fit a line showing the average return to the stock at different market returns. *Beta is the slope of that fitted line*

12.2 WHAT CAN YOU LEARN FROM BETA?

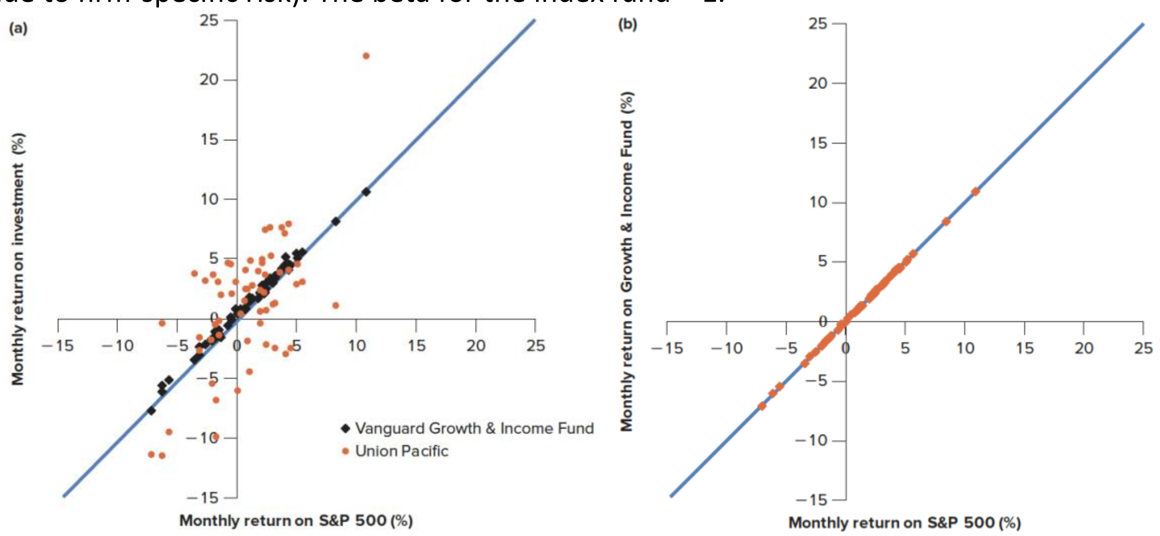
Portfolio betas

Diversification decreases variability from unique risk (Not market risk). Thus, the beta of a portfolio is just an average of the betas in the securities in the portfolio. *E.g. of portfolio with two stocks:*

$$Beta\ of\ portfolio = (\%\ in\ stock\ 1) * (beta\ of\ stock\ 1) + (\%\ in\ stock\ 2) * (beta\ of\ stock\ 2)$$

Firms, mutual funds and index funds

Betas of a specific firm, a mutual fund and an index fund (much higher beta for the individual firm due to firm-specific risk). The beta for the index fund = 1.



12.3 RISK AND RETURN: CAPM

Market risk premium

Risk premium of the market portfolio. Difference between market return and return on risk-free treasury bills.

$$Market\ risk\ premium = r_m - r_f$$

CAPM (Capital assets pricing model)

A model that prices capital assets (stocks). Theory of the relationship between risk and return.

$$Expected\ return = r_f + \beta * (market\ risk\ premium)$$
$$Expected\ return = r_f + \beta * \left(r_m - r_f\right)$$

Where

- r_f: the risk-free interest rate
- r_m: the return on the market portfolio
- β: the beta for the firm under consideration

CAPM: The expected return of a given security should equal the risk-free return, plus a compensation for taking on risk

- You only get compensated for market risk, not unique risk which can be diversified away
- The level of compensation for risk depends on your market risk (beta), i.e. how your security fluctuates with the market

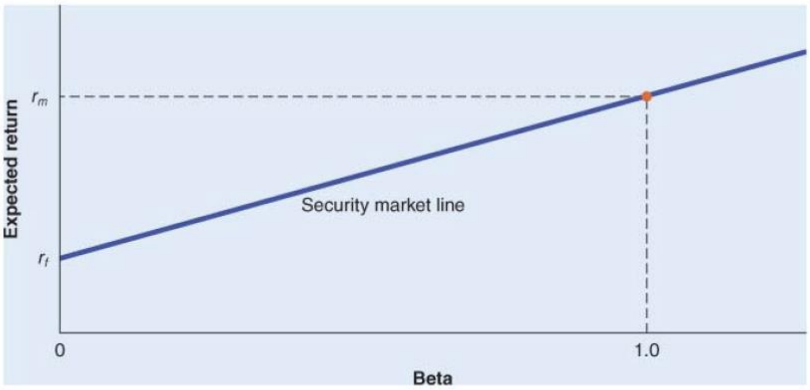
Expected return depends on beta

- If a security return fluctuates like the market (beta=1, i.e. same risk as the market portfolio), then an investor expects to receive the same return as the market portfolio provides
- If a security return fluctuates less than the market (beta<1), then an investor expects to receive a return that is lower than what the market portfolio provides
- If a security return fluctuates more than the market (beta>1), then an investor expects to receive a return that is higher than what the market portfolio provides

CAPM – Graphically

Security market line

- The graphic representation of the CAPM
- Note intercept (r_f) and slope ($r_m - r_f$)
- Note the level of return (relative to r_m) if beta is greater/less than I
    - *If beta is 1, you get the same return as the market return*



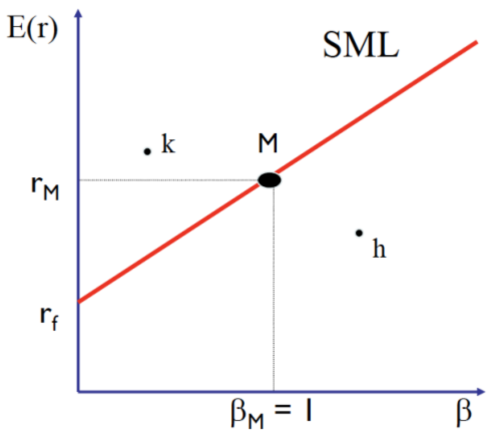
Different stocks have different risk levels (different betas). Thus, they have different expected returns:

Company	Beta	Expected Return (%)
U.S. Steel	3.01	24.1
Marathon Oil	2.39	19.8
Amazon	1.47	13.3
Disney	1.39	12.7
Ford	1.26	11.8
Boeing	1.24	11.7
Intel	1.07	10.5
GE	1.06	10.5
Pfizer	1.02	10.1
IBM	0.94	9.6
Alphabet	0.94	9.6
Union Pacific	0.90	9.3
ExxonMobil	0.82	8.8
Starbucks	0.75	8.2
Coca-Cola	0.70	7.9
McDonald's	0.68	7.8
Campbell Soup	0.40	5.8
Walmart	0.37	5.6
Pacific Gas & Electric	0.15	4.1
Newmont Mining	0.10	3.7

CAPM pricing

SML shows the relationship between expected return and risk of individual securities.

1. Securities that lie below the SML, like **h**, are "overpriced" - in the sense that a security with this level of risk should yield a higher return (the return is lower than what CAPM states it should be).
2. Securities that lie above the SML, like **k**, are "underpriced" - in the sense that a security with this level of risk should yield a lower return (the return is higher than what CAPM states it should be).



EXAMPLE

	Expected return	Standard deviation	Beta
Stock of Maersk	4%	18%	1.5
Market return	8%	13%	
Risk free interest	2%		

1. Write down the equation for the Security Market Line and calculate Maersk's excess return above/below the fair return.

CAPM:

$$E(r) = r_f + \beta(r_m - r_f)$$

$\Leftrightarrow$

$$E(r) = 2\% + 1.5(8\% - 2\%) = 11\%$$

Stock of Mærsk offers a worse return (4%) than what is fair (11%) given its risk level (return 7% below fair return)

2. Explain intuitively whether the stock is overpriced, underpriced or fairly priced.

Stock of Mærsk is overpriced, i.e. its expected return is lower than the CAPM predicts.

12.4 THE CAPM AND THE OPPORTUNITY COST OF CAPITAL

Project evaluation

- We should discount future cash flows with the opportunity cost of capital
- Cost of capital is the return on the best alternative with same level of risk (i.e. same beta)

Project cost of capital

Minimum acceptable expected rate of return on a project given its risk.

But what is the expected return on the best alternative investment (say, a stock) with the same level of risk (same beta)?

- CAPM can provide the answer
- Exp.ret= $r_f + \beta(r_m - r_f)$
- r_m & r_f same for all projects
- Beta is specific to each project (do not use overall firm/stock beta)
- Bottom line: If we know project beta, we can estimate the opportunity cost of capital with CAPM (i.e. the expected/fair return given level of risk)

EXAMPLE

Assume r_f = 4% and r_m = 14%. The ABC company is investing in

- 1/3 computer hardware manufacturing, β = 2.0
- 1/3 ship demolition, β = 1.0
- 1/3 dog food production, β = 0.6

The average beta for the firm is:
(1/3 · 2.0) + (1/3 · 1.0) + (1/3 · 0.6) = 1.2

The ABC company cost of capital:
4% + 1.2 · (14% - 4%) = 16%

But when evaluating a new dog food production project, the cost of capital is:

4% + 0.6 · (14% - 4%) = 10%

Company cost of capital
Setting opportunity cost of capital for each project is too big of a hassle for a big firm. Therefore, they have company cost of capital, which is the opportunity cost of capital for investment in the firm as a whole. The company cost of capital is the appropriate discount rate for an average-risk investment project undertaken by the firm.

What determines a projects risk?
First, we saw that operating leverage increases the risk of a project. When a large fraction of your costs is fixed, any change in revenues can have a dramatic effect on earnings. Therefore, projects that involve high fixed costs tend to have higher betas.

A word of caution
- The cost of capital depends on the market risk of the project (project beta)
- Thus, in any NPV calculation the discount rate should reflect only market risk of the project
- So do not “add fudge factors” to discount rates (personal worries about bad outcomes)
- Because the cash-flow forecast should already reflect the probabilities of all possible outcomes

A word about the CAPM
The CAPM usually does not hold. Not only market returns and beta explains return of diversified portfolios. Other factors are also important.
In general, we can have a multi-factor model of size N:

$$r_p = \beta_1 F_1 + \beta_2 F_2 + \cdots + \beta_N F_N$$

These market factors can be anything:
- Market interest rates
- Inflation
- Oil prices
- …Anything that is statistically significant

Fama-French 3 factor model
Fama and French came up with three factors that explain most of the variation in return:
1. Market return
2. Firm size
3. Firm value

$$R_{it} = \alpha + \beta * MKT_t + \theta * SMB_t + \gamma * HML_t$$

Where:
- MKT: return of the market portfolio in excess of the risk-free rate
- SMB: return on small stocks minus return on big stocks
- HML: return on high value stocks minus ret. on low value

Small firms and high value stock have abnormally high returns even after accounting for beta.

Topic 7: WACC

Chapter 13: The Weighted-Average Cost of Capital and Company Valuation

13.1 GEOTHERMAL'S COST OF CAPITAL

Capital structure

The mix of long-term debt and equity financing.

Advantages of debt

Interest payments on debt are deducted from income before tax is calculated. More debt, less tax (but there is a downside as well).

13.2 THE WEIGHTED-AVERAGE COST OF CAPITAL

Company cost of capital

Opportunity cost of capital for investment in the firm as a whole. The company cost of capital is the appropriate discount rate for an average risk investment project undertaken by the firm.

Calculating company cost of capital as a weighted average

The company cost of capital is a weighted average of the returns demanded by debt and equity investors. The weighted average is the expected rate of return investors would demand on a portfolio of all the firm's outstanding securities.

Firm value:

$$V = D + E$$

- V = Total market value of firm
- D = Outstanding debt
- E = Equity

Company cost of capital

Weighted average of debt and equity returns.

$$r_{assets} = \frac{total\ income}{value\ of\ invesment}$$

$\Leftrightarrow$

$$r_{assets} = \frac{(D * r_{debt}) + (E * r_{equity})}{V} = \left(\frac{D}{V} * r_{debt}\right) + \left(\frac{E}{V} * r_{equity}\right)$$

- Debtholders need income of $(r_{debt} * E)$
- Equity investors need expected income of $\left(r_{equity} * E\right)$
- The total income that is needed is $(D * r_{debt}) + (E * r_{equity})$
- The amount of their combined existing investment in the company is V

To find return on equity:

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

Use market weights, not book weights

The cost of capital must be based on what investors are actually willing to pay for the company's outstanding securities— that is, based on the securities' market values.

TAXES AND WACC

After tax costs of debt

With a corporate tac rate of 35%, the government bears 35% of the cost of the interest payments. The income tax that the firm pays is reduced by 35%. Therefore, companies' after-tax cost of debts is only $100 - 35 = 65\%$ of the 8% pretax cost:

$$After - tax\ cost\ of\ debt = \begin{matrix} (1 - tax\ rate) * pretax\ cost \\ (1 - T_c) * r_{debt} \\ (1 - 0.35) * 8\% = 5.2\% \end{matrix}$$

WACC

Expected rate of return on a portfolio of all the firm's securities, adjusted for tax savings due to interest payments. It is calculated by:

$$WACC = \left[\frac{D}{V} * (1 - T_c) * r_{debt}\right] + \left(\frac{E}{V} * r_{equity}\right)$$

More sources of financing

If the firm has issued other classes of securities, the WACC approach is unchanged.

E.g.: If a firm has issued preferred stock:

$$WACC = \left[\frac{D}{V} * (1 - T_c) * r_{debt}\right] + \left(\frac{P}{V} * r_{preferred}\right) + \left(\frac{E}{V} * r_{equity}\right)$$

NPV and taxes

A firm forecast revenues, costs, and taxes as if the project were to be all-equity-financed. The interest tax shields generated by the project's actual debt financing are accounted for by using the after-tax cost of debt in the weighted-average cost of capital.

Logic between rate of return, NPV and WACC:

With an investment of \$30 million, the internal rate of return on this perpetuity is exactly 11.4%:

$$\text{Rate of return} = \frac{3.42}{30} = .114, \text{ or } 11.4\%$$

and NPV is exactly zero:

$$\text{NPV} = -30 + \frac{3.42}{.114} = 0$$

NOTE: If a project has zero NPV when the expected cash flows are discounted at the weighted-average cost of capital, then the project's cash flows are just sufficient to give debtholders and shareholders the returns they require.

13.3 INTERPRETING THE WEIGHTED-AVERAGE COST OF CAPITAL

Interpreting the WACC

WACC is an appropriate discount rate only for a project that is a carbon-copy of the firm's existing business. This benchmark should be adjusted upward (downward) for unusually risky (safe) projects.

Some common mistakes

The inputs in the WACC formula are endogenous → Affect each other. Cannot change without changing another.

- Increasing the debt ratio: Will at first decrease the WACC if nothing else is changed. However, as the borrowing is increased, the risk of the common stock is increased, therefore, investors would demand more return. Furthermore, the debt issuers will also demand a higher interest.

13.4 PRACTICAL PROBLEMS: MEASURING CAPITAL STRUCTURE

Financial managers usually start with the company's accounts, which show the book value of debt and equity, whereas the weighted-average cost of capital formula calls for their market values.

Looking at the different posts:

- Bank debt: Most financial managers most of the time are willing to accept the book value of bank debt as a fair approximation of its market value.
- Long-term bonds: To find the market value of the bonds, you need to calculate PV (present value)
- Equity: It is a big mistake if you use the book values of the equity. The total market value of the stock equals:

$$Number\ of\ shares * share\ price$$

A market value balance sheet:

Assets		Liabilities and Equity		
Net working capital (= current assets − current liabilities)	$ 120.0	Bank debt	$ 200.0	12.6%
Value of PP&E and other long-term assets (including intangible assets)	1,465.7	Long-term bonds (market value = 93% par value)	185.7	11.7
		Total debt	385.7	24.3
		Common stock (100 million shares, par value = $1)	1,200.0	75.7
Value	$1,585.7	Value	$1,585.7	100.0%

13.5: MORE PRACTICAL PROBLEMS: ESTIMATING EXPECTED RETURNS

To calculate a firm's weighted-average cost of capital, you also need the rate of return that investors require from each security.

- The expected rate of return on debt in bank
  - $r_{debt} = interest\ rate\ on\ loans$
- The expected rate of return on bonds
  - $r_{debt} = YTM$
- The expected return on common stock
  - Here we can use the CAPM model to find the cost of equity (expected return).
  - Estimates provided by the CAPM model can be checked by the dividend discount model. It is found by:

$$P_0 = \frac{DIV_1}{r_{equity} - g}$$

And r_{equity} can be found by:

$$r_{equity} = \frac{DIV_1}{P_0} + g$$

- The expected return on preferred stock

- Preferred stock that pays a fixed annual dividend can be valued from the perpetuity formula:

$$Price\ of\ preferred = \frac{dividend}{r_{preferred}}$$

And $r_{preferred}$ can be found by:

$$r_{preferred} = \frac{dividend}{price\ of\ preferred}$$

13.6 VALUING ENTIRE BUSINESSES

Data needed to calculate WACC:

Security Type	Capital Structure		Required Rate of Return
Debt	$D = \$\ \ 385.7$	$D/V = 0.243$	$r_{debt} = 0.09$, or 9%
Common stock	$E = \$1{,}200.0$	$E/V = 0.757$	$r_{equity} = 0.12$, or 12%
Total	$V = \$1{,}585.7$		

Free cash flow (FCF)

Cash flow available for distribution to investors after firm pays for new investments or additions to working capital:

$$\begin{aligned} FCF = &\ \text{Profit after tax} \\ &+ \text{depreciation} \\ &- \text{investment in fixed assets} \\ &- \text{investment in working capital} \end{aligned}$$

Calculating the value of the deconstruction business

The value of the deconstruction operation is equal to the discounted value of the free cash flows out to a horizon plus the forecast value of the business at the horizon:

$$PV = \underbrace{\frac{FCF_1}{1 + WACC} + \frac{FCF_2}{(1 + WACC)^2} + \cdots + \frac{FCF_H}{(1 + WACC)^H}}_{\text{PV (free cash flows)}} + \underbrace{\frac{PV_H}{(1 + WACC)^H}}_{\text{PV (horizon value)}}$$

We assume that beginning in year 6 the business is expected to settle down to steady growth of 5% a year, and so we have picked year 5 as the horizon year:

$$\text{Horizon value} = \frac{\text{free cash flow in year 6}}{r - g} = \frac{303.8}{.085 - .05} = \$8{,}680 \text{ thousand}$$

We now have all we need to calculate the value of the deconstruction business today:

$$\begin{aligned} \text{PV (business)} &= \text{PV (free cash flows years 1–5)} + \text{PV (horizon value)} \\ &= \frac{-32.8}{1.085} + \frac{-71.0}{(1.085)^2} + \frac{-85.2}{(1.085)^3} + \frac{-54.8}{(1.085)^4} + \frac{183.4}{(1.085)^5} + \frac{8{,}680}{(1.085)^5} \\ &= \$5{,}697.5 \text{ thousand} \end{aligned}$$

This is then the combined value of debt and equity. If you need to value the equity, you must subtract the value of any outstanding debt.

Topic 8: Debt policy

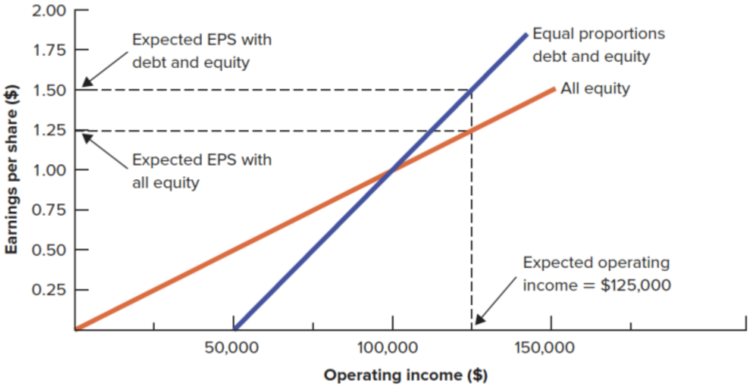
Chapter 16: Debt policy

16.1 HOW BORROWING AFFECTS VALUE IN A TAX-FREE ECONOMY

When there are no taxes and capital markets function well, the market value of a company does not depend on its capital structure. In other words, financial managers cannot increase value by changing the mix of securities used to finance the company.
Restructuring: Process of changing the firm's capital structure without changing its real assets.
Debt ratio: $\frac{D}{D+E}$ (Book values)

How borrowing affect earnings per share

Debt can either increase or reduce the return to the equity shareholder.



Data				
Number of shares	50,000			
Price per share	$10			
Market value of shares	$500,000			
Market value of debt	$500,000			
Outcomes				
		State of the Economy		
		Slump	Normal	Boom
Operating income		$75,000	$125,000	$175,000
Interest		$50,000	$ 50,000	$ 50,000
Equity earnings		$25,000	$ 75,000	$125,000
Earnings per share		$0.50	$1.50	$2.50
Return on shares		5%	15%	25%
			Expected outcome	

- Borrowing increases River Cruises' earnings per share (EPS) when operating income is greater than $100,000
- It reduces it when operating income is less than $100,000.
  - Expected EPS rises from $1.25 to $1.50.

<u>MM's proposition I (debt-irrelevance proposition)</u>

Under idealized conditions the value of a firms is unaffected by its capital structure.

- The value cannot be increased by changing the mix of securities used to finance the company
- The value of a firm does not depend on how its cash flows are "sliced" (the size of pizza does not change depending on how you slice it)

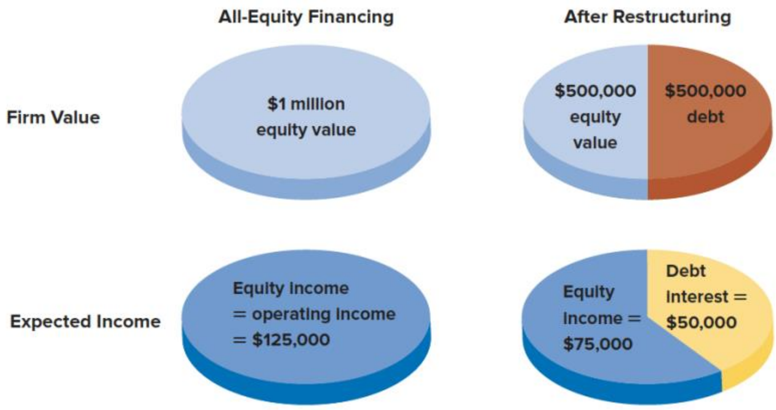
Assumptions for this to hold:

- Debt is risk free (bondholders always get repaid)
- No taxes
- No bankruptcy costs or financial distress costs (cf. high leverage)
- No investor constraints (e.g. borrowing constraints)
- No management incentive effects (e.g. inflating stock price)

When we get rid of these assumptions, we see that these factors actually affect the capital structure of a company.

MM I: How debt affects risk and return

- Operating risk: Risk in firm's operating income. Also called business risk
- Financial leverage: Debt financing to amplify the effects of changes in operating income on the returns to stockholders.
- Financial risk: Risk to shareholders resulting from the use of debt.



Debt finance does not affect operating risk, but it does add financial risk. With only half the equity to absorb the same amount of operating risk, risk per share must double.

- If borrowing doubles, the upside and downside returns for River Cruises' stock, what happens to beta? It also doubles.

	Current Structure: All Equity	Proposed Structure: Equal Debt and Equity
Expected earnings per share	$1.25	$1.50
Share price	$10	$10
Expected return on share	12.5%	15.0%

Conclusion: leverage increases the expected return to shareholders, but it also increases the risk. The two effects cancel, leaving shareholder value unchanged (cf. "irrelevance of debt").

16.2 DEBT AND THE COST OF EQUITY

The opportunity cost of capital for the company's assets

$$r_{assets} = \left(r_{debt} * \frac{D}{V}\right) + \left(r_{equity} * \frac{E}{V}\right)$$

Note: Market values, not book values, and we are still ignoring taxes.

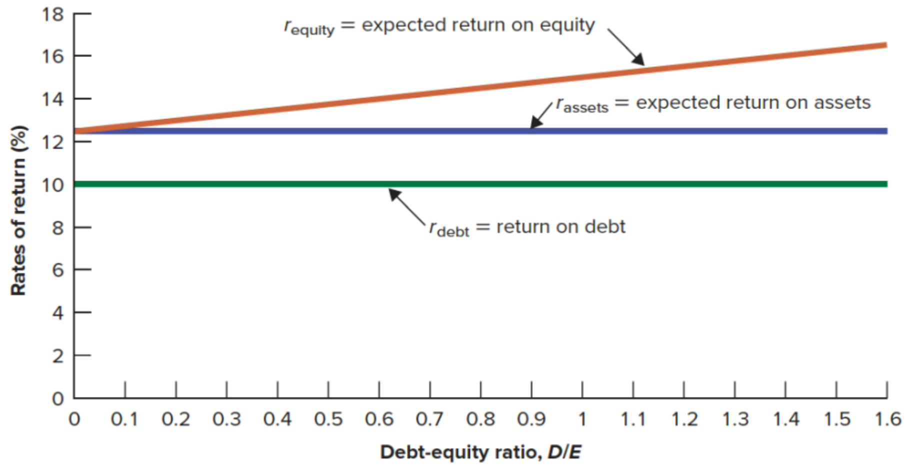
<u>MM's proposition II</u>

The required rate of return on equity increases as the firm's debt-equity ratio (D/E) increases:

$$r_{equity} = r_{assets} + \frac{D}{E}(r_{assets} - r_{debt})$$

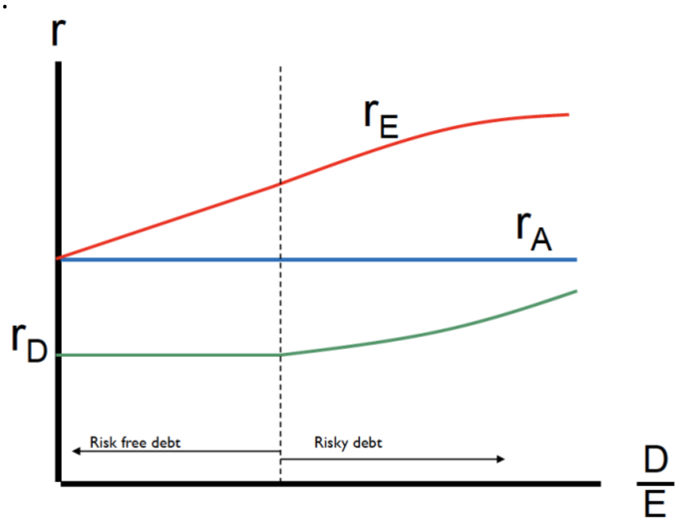
NOTE: But debt also increases financial risk and causes shareholders to demand a higher return on their investment. Once you recognize this implicit cost, debt is no cheaper than equity—the return that investors require on their assets is unaffected by the firm's borrowing decision

MM II – graphically:



r_A is unchanged, no matter how much the firm borrows. But expected return on part of the package does change (r_e)

When debt is not risk-free anymore:
You can see that as the firm borrows more, the risk of default increases and the firm has to pay higher rates of interest.



The overall effect: Does not affect overall results on r_A. Overall firm value the same for any capital structure.

16.3 DEBT, TAXES, AND THE WEIGHTED-AVERAGE COST OF CAPITAL
Interest tax shield (adding taxes to the model)
Tax savings resulting from deductibility of interest payments. It can be a safe perpetuity one must take into account since it can have great value.
Annual tax shield (calculation):

$$Annual\ tax\ shield = Tax\ rate * Interest\ payment$$

PV Calculation:

$$PV = \frac{(r_A * D) * T}{r_A} = D * T$$

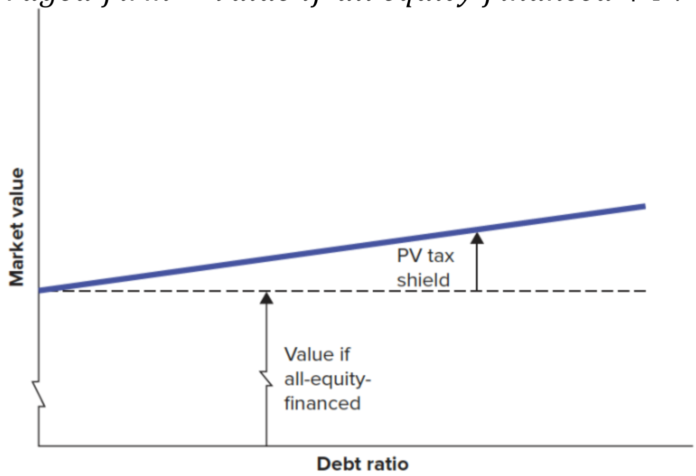
E.g. if a firm gets a permanent stream of tax savings per year of $17,500, it will have the following PV with a discount rate of 10%:

$$PV\ interest\ tax\ shield = \frac{17{,}500}{0.1} = 175{,}000$$

Interest tax shields and value of stockholders' equity

Borrowing reduces the firms tax bill and increases the cash payments to the investors:

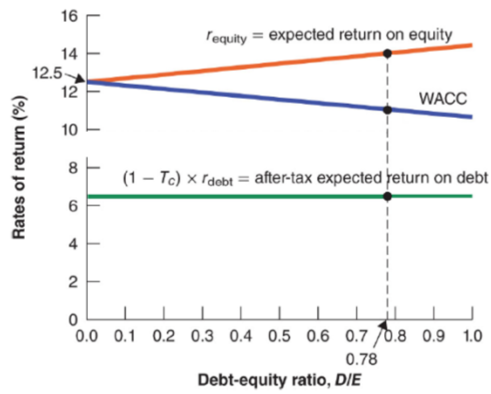
$$Value\ of\ leveraged\ firm = value\ if\ all\ equity\ financed + PV\ of\ tax\ shield$$



Taxes and MM II

Expected return on equity rises with leverage, but now the rise is less rapid. Lower slope compared to the first case (i.e. where debt is risk free, fig. 16-3)

→ Net effect: A downward sloping r_A line *(The r_A line – the cost of capital for the firm – now corresponds to WACC, since it takes account of taxes)*

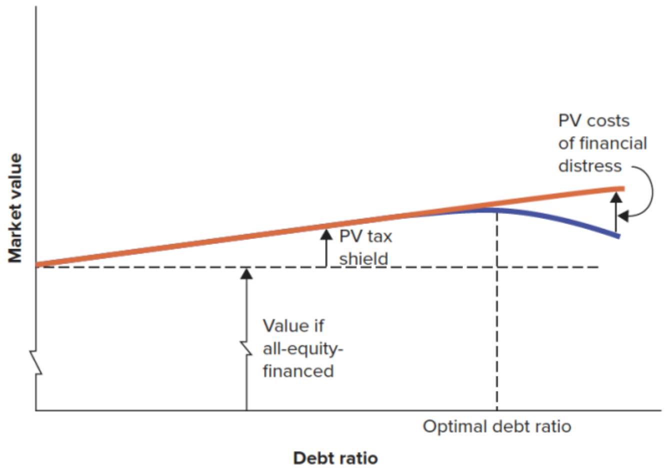


16.4 COSTS OF FINANCIAL DISTRESS

Cost of financial distress

Costs arising from bankruptcy or distorted business decisions before bankruptcy.

$$Overall\ market\ value = V\ if\ all\ equity\ financed + PV\ tax\ shield - PV\ costs\ of\ financial\ distress$$



- At moderate debt levels the probability of financial distress is trivial, and therefore, the tax advantages of debt dominate.

- But at some point, additional borrowing causes the probability of financial distress to increase rapidly, and the potential costs of distress begin to take a substantial bite out of firm value.
- The theoretical optimum is reached when the present value of tax savings from further borrowing is just offset by increases in the present value of costs of distress.

Trade-off theory: Debt levels are chosen to balance the costs of financial distress.

Bankruptcy costs
If a company cannot pay its debts, the firms is turned over to the creditors, who become the new owners; the old stockholders are left with nothing.
- In this case, bankruptcy is not the cause of the decline in the value of the firm. It is the result.
- Direct costs: lawyers and court fees.
- Indirect costs: lost business opportunities, employees leaving, risk shifting (stockholders may want very risky projects, since limited downside when close to bankruptcy anyway)
- These costs matter at high level of debt

Financial distress without bankruptcy
- Risk shifting: Firms threatened with default are tempted to shift to riskier investments, since they will go under either way.
- Debt overhang: Firms threatened with default may pass up positive-NPV project because bondholders capture part of the value added.

EXERCISE
A shipping company is fully equity financed (a total of \$100,000). It does not need more funding, but decides to change its debt-to-equity financing ratio to 1 permanently, since bondholders only require a 5% return whereas shareholders require a 12% return. Assuming a corporate tax rate of 20% (but risk free debt and no distress costs), by how much does the market value of the firm change when it changes its capital structure?
a) It increases by 6.3%
b) It increases by 8.0%
c) It increases by 10.0%
d) It decreases
e) It does not change

Initially: E=100,000 and D=0. But then $\frac{D}{E} = 1 \rightarrow \frac{50,000}{50,000}$
$r_d = 5\%$ and $r_e = 12\%$ and $T = 20\%$
The actual question is what the value of the tax shield is, because this is what increases the market value of the firm.
$$V\ of\ leveraged\ firm = V\ of\ folly\ eq.firm + PV(tax\ shield)$$
⇔
$$Interest\ payments = 5\% * 50,000 = 2,500$$
The annual tax shield is then:
$$Annual\ tax\ shield = 20\% * 2500 = 500$$

And the PV of the tax shield:

$$PV(Tax\ shield) = \frac{500}{0.05} = 10{,}000$$

Why use 5% to discount with? We use the discount rate of debt (bondholders).
Now we can insert:

$$V\ of\ leveraged\ firm = 100{,}000 + 10{,}000 = 110{,}000$$

Conclusion: It increases by 10% (c).

16.5 THEORIES FOR CHOOSING DEBT LEVEL

The maximum value of firm

Is when:

$$Marginal\ PV(tax\ shield) = Marginal\ PV(cost\ of\ distress)$$

If the PV(tax shield) of adding more debt is higher than the PV(cost of distress) of doing so, then you should add more debt – and vice versa. Thus, optimal level reached where these two are equal.

1. Trade-off theory

The theory that capital structure is based on trade-off between tax savings and distress costs of debt.

- Explains industry differences:
  - Companies with safe, tangible assets and plenty of taxable income to shield ought to have high debt levels – and vice versa
- Does not explain low debt of the most successful companies
  - In real-life the most stable and profitable companies (high income) generally borrow the least

2. Pecking order theory

States that firms prefer to issue debt rather than equity if internal finance is insufficient.
Order of preference:

1. Internal funds (sends no signal to the market)
2. Debt (not clear that it will send a negative signal)
3. Equity (likely to be interpreted as a negative signal)

Why does nothing happen when issuing debt?

- Debtholders share in the success of the firm only to a minimal extent (i.e., to the extent that bankruptcy risk falls), an issue of debt is not usually taken as a signal that a firm's management has concluded that the market is overvaluing the firm. Thus, debt issues are not signals of the firm's future success and they therefore do not induce investors to reassess the value of the firm.

Why does the share decrease from equity financing?

- Asymmetric information: managers know more than outside investors
- Announcing a stock issue signals "the firm will benefit from selling stock at current market prices"
- Or in other words "the firm's stock is currently overvalued"
- Indeed, announcement of stock issue typically drives down stock price

This theory explains why successful companies do not borrow:

- They don't need outside funding

- Use internal funding (i.e. internal equity – equity already inside the firm – not external equity)
- Thus, relatively low D/E ratios

Pecking order theory does not explain why some fast-growing (high-tech) firms often resort to external equity. A series of common stock issues to finance their investments. Avoid too much debt.

3. Theory of financial slack

Having ready access to cash or debt financing. The idea is:

- Retain flexibility by having ready access to funds for new projects when they come along (avoid missing out on opportunities)
- Avoid too much leverage – so you can easily add more debt
- Most valuable to firms with a lot of positive NPV growth opportunities
    - So explains financing of fast-growing (high tech) companies

The free-cash-flow problem:

- Companies with ample cash flow are tempted to overinvest and to operate inefficiently. Companies facing this problem may benefit from the discipline imposed by more debt and higher debt-service requirements.

Practical problem with these theories

In contrast to MM with marginal PV(tax)=marginal PV(distress), these give no clear indication of whether debt levels or too high or low.

EXERCISE

D/E*

- A firm pays 5% on its outstanding debt per year. The tax rate is 30%.
- The PV of the tax shield can be summarized in the formula: $(0.05\times D)\times 0.30 \ / \ 0.05 = D\times 0.30$
- The cost of financial distress is 0.1% of outstanding debt, although it increases non-linearly with leverage. More precisely, assume distress costs can be described with $0.001 \cdot D^2$ per year. Also assume that this cost is discounted at 10%.
- According to MM, what is the optimal level of debt the firm should hold?

We set up the function for maximizing:

$$Marginal\ PV(tax) = Marginal\ PV(distress)$$

PV(Tax)= $D * 0.3$

PV(Distress)= $\frac{D^2 * 0.001}{0.1} = 0.01 * D^2$

Differentiated:

$$0.30 = 0.02D$$

$\Leftrightarrow$

$$\boldsymbol{D = 15}$$

The Economist (E3)

"What if interest expenses were no longer tax-deductible?"

Interest expense deduction may be removed

- To fund Trump's corporate tax cuts
- Deduction worth 11% of value of corporate assets

The Economist favors abduction

- Debt incentives increase risk
- Increases government revenue
- Can cut corporate tax rate from 35% to 15%
- Firms with low debt gain more (from no deduction + lower corp. tax), e.g. investment grade and private equity.

But not clear-cut:

- Doubt on scale of gain/loss to different firms
- Even if tax shield goes, cost of debt is historically low => still high debt levels
- Firms can still borrow in other countries where there is tax shield
- If issuers of junk-bonds do not get tax shield, it causes difficulty of repayment / refinance

=> Could be dangerous to fiddle with the tax code at this time (default on the rise)

Topic 9: Payout policy

Chapter 17: Payout policy

17.1 HOW CORPORATIONS PAY OUT CASH TO SHAREHOLDERS

Corporations pay out cash to their shareholders in two ways. They can pay a cash dividend or repurchase some outstanding shares.

How firms pay dividends

A firm announces (declaration date) when it wants to pay a dividend (the payment date) to all shareholders recorded in the books on a specific date (the record date).

- Cash dividend: Payment of cash by the firm to its shareholders.
- Ex-dividend: Without the dividend. Buyer of a stock after the ex-dividend date does not receive the most recently declared dividend.
  - Ex-dividend date: Date that determines whether a stockholder is entitled to a dividend payment. Anyone holding stock before this date is entitled to a dividend
- Record date: Date where the relevant owners (buying before ex-dividend date) receive payment

Stock dividends and stock splits

Stock dividends and splits: Distributions of additional shares to a firm's stockholders. More often than not, the announcements of a stock split do result in a rise in the market price of the stock, even though investors are aware that the company's business is not affected.

Reverse splits: Sometimes, companies with very low stock prices use reverse splits to increase price per share.

Example of stock dividend

- There are 50 shares outstanding and you own 10 (20%)
- 10% stock dividend implies you receive 1 additional share for each 10 you already hold
- Now you own 11 of a total of 55
- You still own 20% of the company! How are you better off?

Stock repurchases

Firm distributes cash to stockholders by repurchasing shares. Can be done in four ways (page 509).

1. Open market repurchases (most common)
2. Tender offer to shareholders
3. Auction
4. Direct negotiation

Signals of stock dividend

- Stock dividend often taken as a positive signal for future prospects of the firm
- So, your 11 shares are more valuable than your previous 10 shares
- Signal that share price has been increasing (thus the division of each share into more affordable units) and people assume this growth will continue in the future

17.2 THE INFORMATION CONTENT OF DIVIDENDS AND REPURCHASES

Dividend increases convey managers' confidence about future cash flow and earnings. Dividend cuts convey lack of confidence and therefore are bad news.

1. There is also information content in stock repurchases. Repurchases can be signals of managers' optimism and may indicate their view that the company's shares are underpriced by investors.
    - News about a planned repurchase is less strongly positive than the announcement of a dividend increase.

17.3 DIVIDENDS OR REPURCHASES? THE PAYOUT CONTROVERSY

Repurchases and the Dividend discount model

When the dividend changes, we must be aware of the dividend discount model.

E.g.: The stock price in panel B is ex-dividend, so the next payout of $100,000 ($1 per share) will come next period. Discount is 10%

$$P_0 = \frac{DIV_1}{r-g} = \frac{\$1}{0.1-0} = \$10$$

Next year, it will pay out exactly 50% of earnings as cash dividends and 50% as repurchases. The dividend will therefore be $0.5. The repurchase is enough to offset a growth of 5% a year.

$$P_0 = \frac{\$0.5}{0.1-0.05} = \$10$$

1. **Step 1:** Calculate equity market capitalization (the value of all outstanding shares) by forecasting and discounting the free cash flow. Free cash flow is the amount that will be paid out to all current and future shareholders either as dividends or by stock repurchases (net of any issues of stock).
2. **Step 2:** Calculate price per share by dividing market capitalization by the number of shares currently outstanding. That way you don't have to worry about how payout is split between dividends and repurchases

Conclusion: The dividend discount model is not upset by repurchases as long as you are careful to forecast earnings and dividends per share.

- Cash dividends: Does not affect shareholders as well. Total wealth will be the same.

Assets		Liabilities and Shareholders' Equity	
A. Original balance sheet			
Cash	$ 150,000	Debt	$ 0
Other assets	950,000	Equity	1,100,000
Value of firm	$1,100,000	Value of firm	$1,100,000
Shares outstanding = 100,000			
Price per share = $1,100,000/100,000 = $11			
B. After cash dividend of $1 per share			
Cash	$ 50,000	Debt	$ 0
Other assets	950,000	Equity	1,000,000
Value of firm	$1,000,000	Value of firm	$1,000,000
Shares outstanding = 100,000			
Price per share = $1,000,000/100,000 = $10			
C. After $100,000 stock repurchase program			
Cash	$ 50,000	Debt	$ 0
Other assets	950,000	Equity	1,000,000
Value of firm	$1,000,000	Value of firm	$1,000,000
Shares outstanding = 90,909			
Price per share = $1,000,000/90,909 = $11			

See examples in slides for lecture 9.

EXAMPLE

- The market value balance sheet for Jones Associates Inc. is shown below:

Cash	$20,000	Debt	$10,000
Fixed assets	$30,000	Equity	$40,000
Total	$50,000	Total	$50,000

- The firm has 1,000 shares outstanding and has declared a 25% stock dividend. Mr. Jones owns 400 shares of the firm's common stock.
- Using the same table as shown above for Jones Associates Inc., how does the stock dividend affect the price per share of stock?
- What is the effect of the stock dividend on the firm's market value (increase/decrease/same)?

Before the stock dividend:

$$Stock\ price = \frac{Equity}{Shares\ outstanding} = \frac{40{,}000}{1{,}000} = \$40$$

After the stock dividend:

$$Stock\ price = \frac{40{,}000}{1{,}250} = \$32$$

The effect of stock dividend on market value:

It has no effect.

The investor before:

- $Cash = 0$
- $Stocks = 400 * 40 = \$16{,}000$
- $\%\ of\ firm = \frac{400}{1000} = 40\%$

The investor after:

- $Cash = 0$
- $Stocks = 500 * 32 = 16{,}000$

- $\% \ of \ firm = \frac{500}{1250} = 40\%$

The arguments for payout policy being irrelevant

Dividends do not really matter to investors

- Dividends and stock repurchase equivalent (case B, C, D in example)
- Cases also the same as when firm does not pay out (case A), i.e. total wealth the same.
- Moreover, investors do not need dividends to convert shares to cash
- They can create cash flows themselves by selling part of their shares (creating their own "dividends")

Dividend policy does not impact the value of the firm

- The overall value of your shares is the same regardless of the payout policy chosen
- Furthermore, why should you pay higher prices for firms with higher dividend payouts?
- This is consistent with the Modigliani-Miller arguments on the irrelevance of capital structure (firm's actions meaningless since investors can do it themselves)
- .... but remember assumptions? (transaction costs)

17.4 WHY DIVIDENDS MAY INCREASE VALUE

Clientele effects

- There are investors who for different reasons prefer high payout stocks
    - Small or elderly investors: stable cash dividend
    - Funds or foundations: restricted from holding stock with no income stream
- Drive up demand (price) of stock and/or willing to pay a premium for high-payout stocks

Signaling: Only firms expecting to be profitable in the future will pay out (increase) dividends

17.5 WHY DIVIDENDS MAY REDUCE VALUE

Arguments:

The money paid out will no longer be available to finance new investments

- And costly to raise new capital (in contrast to MM assumption of perfect capital markets)

Dividends typically taxed more heavily than capital gains

- Cost to shareholders
- Suggests that money should be paid out by share repurchases
- But cannot do consistently, as this is blunt tax avoidance

Dividends at fast-growing companies may be bad for share prices

- Evidence suggests that when companies that have never paid out dividends start to do so, it decreases share price
- May signal that firm has run out of good investment ideas (opposite to argument on previous slide!)

	Firm A	Firm B
Next year's price	\$112.50	\$102.50
Dividend	\$0	\$10.00
Total *pretax* payoff	\$112.50	\$112.50
Today's stock price	\$100	\$97.78
Capital gain	\$12.50	\$4.72
Before-tax rate of return (%)	$\frac{12.5}{100} = .125 = 12.5\%$	$\frac{14.72}{97.78} = .1505 = 15.05\%$
Tax on dividend at 40%	\$0	$.40 \times \$10 = \$4.00$
Tax on capital gain at 20%	$.20 \times \$12.50 = \$2.50$	$.20 \times \$4.72 = \$.94$
Total after-tax income (dividends plus capital gains less taxes)	$(0 + 12.50) - 2.50 = \$10.00$	$(10 + 4.72) - (4.00 + .94) = \$9.78$
After-tax rate of return (%)	$\frac{10}{100} = .10 = 10\%$	$\frac{9.78}{97.78} = .10 = 10\%$

When firms choose payout policy, they must consider the taxation of capital gain vs. taxation on dividends.

17.6 PAYOUT POLICY AND THE LIFE CYCLE OF THE FIRM

The firm should make investment and financing decisions and then distribute whatever cash is left over. If payout is a residual, then payout decisions should evolve over the life cycle of the firm.

- Young firms: Have plenty of investment opportunities. During this time, it is efficient to retain and reinvest all operating cash flow.
- Mature firms: Positive NPV project become scarcer relative to cash flow. The firm begins to accumulate cash. Now investors begin to worry about free-cashflow problems—for example, overinvestment or excessive perks. If firms do not start paying out dividends, the stock price will drop.
- Aging firms: As the firm ages, more and more payout is called for. The payout may come as higher dividends or larger repurchases. Sometimes, the payout comes as the result of a takeover

The Economist (E4)

Share buy-backs at record high

- 97% of firms in S&P500 have bought back shares, more than paid dividends
- Half of money returned to shareholders is in form of buyback
- Driven by biggest companies
- May rise further due to new tax rules encouraging firms to repatriate funds in foreign subsidiaries

Controversy

- Does it make capital owners even richer and prevent reinvestment? Elizabeth Warren wants partial ban

The Economist disagrees

- Buy-backs sensible, reflecting imbalances such as high profit margins (result, not a cause thereof)

Six muddles:

1. Unnatural. No, flexible and voluntary participation.
2. Create wealth. No, withdrawing from ATM does not make you richer.
3. Motivation to manipulate stock prices or EPS. No, only 1-2% of trading and rules against manipulation.

4. Better if money reinvested. No, often unable to reinvest, in particular abnormally high profits.
5. Lead to low investment. No, inv./GDP unchanged (only cash flows/profits higher).
6. Increase in buy-back signals that corporate-tax reform was not in public interest. No, makes more sense to 1) compare tax decrease vs. investment increase and 2) wages, to evaluate reform.

The Economist argues that the most important warnings signals sent by surging buybacks are:

- Leverage is trending upwards (debt used to finance spending + investment, not internal funds)
- Peak of optimism (last time buy-backs peaked was before 2008 crash)

Topic 10: Merger and Acquisitions

Chapter 21: Mergers, acquisitions, and corporate control

21.1 SENSIBLE MOTIVES FOR MERGERS

- Horizontal merger: One that takes place between two firms in the same line of business; the two companies are competitors

$$V + V = W$$

- Vertical merger: Involves companies at different stages of production. The buyer expands back toward the source of raw materials or forward in the direction of the ultimate consumer

$$V + \Lambda = X$$

- Conglomerate merger: Involves companies in unrelated lines of business.

Many mergers and acquisitions are motivated by possible gains in efficiency from combining operations. These mergers create synergies. By this, we mean that the two firms are worth more together than apart

Possible sources of synergies:

Creating extra value without consuming resources:

1. Economies of scale: The opportunity to spread fixed costs across a larger volume of output. These are the natural goal of horizontal mergers. But these has been claimed in conglomerate mergers, too (sharing services such as accounting, financial services, etc.).
2. Economies of vertical integration: Gaining control and coordination over the production process. Vertical mergers often make sense when two businesses are inextricably linked.
   a. Fallen out of fashion → outsourcing has become more popular recent days
3. Combining complementary resources: Many small firms are acquired by large firms that can provide the missing ingredients necessary for the firm's success – each has what the other needs.
4. Mergers as use for surplus funds: If a firm has excessive funds, and it's not willing to purchase its own shares, it can instead purchase someone else's.
5. Eliminating inefficiencies: There are always firms with unexploited opportunities to cut costs and increase sales and earnings. Such firms are natural candidates for acquisition by other firms with better management

6. Industry consolidation: The biggest opportunities to improve efficiency seem to come in industries with too many firms and too much capacity. The M&A will then force companies to cut capacity and employment, and release capital for reinvestment elsewhere in the economy

21.2 DUBIOUS REASONS FOR MERGERS

Other arguments sometimes given for mergers are more doubtful

1. Diversification: Some firms acquire companies to diversify since diversification reduces risk. The trouble with this argument is that diversification is easier and cheaper for the stockholder than for the corporation
2. The bootstrap game: By merging with firms with selected characteristics, the acquiring firm can get an immediate increase in Earnings Per Share (EPS)
    a. Buying a firm with a lower P/E ratio can increase earnings per share. But the increase should not result in a higher share price. The short-term increase in earnings should be offset by lower future earnings growth.

Example:

	World Enterprises	Muck and Slurry	Merged company
Market value	**$4,000,000**	**$2,000,000**	**$6,000,000 (no synergy)**
Number of shares	100,000	100,000	150,000
=> Price per share	$40	$20	$40
Earnings	$200,000	$200,000	$400,000
=> EPS	**$2.00**	**$2.00**	**$2.67**

Total earnings double, but number of shares increase only by 50%, so EPS goes up. But the acquisition is not adding any value to World Enterprises!

21.3 THE MECHANICS OF A MERGER

The form of acquisition

There are three ways for one firm to acquire another:

1: Merger: Combination of two firms into one, with the acquirer assuming assets and liabilities of the target firm.

2: Tender offer: Takeover attempt in which outsiders directly offer to buy the stock of the firm's shareholders. They can either get the management's approval or do a hostile takeover.

3: Acquisition: Takeover of a firm by purchase of that firm's common stock or assets – and the target may (or may not) continue as a separate firm.

Mergers, antitrust law, and popular opposition

Mergers may be blocked by the federal government if they are thought to be anticompetitive or to create too much market power. Mergers may also be stymied by political pressures and popular resentment even when no formal antitrust issues arise.

Tax inversion: occurs when a corporation restructures itself so that the current parent is replaced by a foreign parent, and the original parent company becomes a subsidiary of the foreign parent, thus moving its tax residence to the foreign country.

21.4 EVALUATING MERGERS

There are two questions that one must think about:

1. Is there an overall economic gain to the merger? In other words, is the merger value-enhancing? Are the two firms worth more together than apart?
$$PV(AB) > PV(A) + P(B)$$
2. Do the terms of the merger make my company and its shareholders better off? There is no point in merging if the cost is too high and all the economic gain goes to the other company.

Mergers financed by cash

Question 1:

The economic gain to the merger is the present value of the extra earnings:
$$Economic\ gain = PV(increased\ earnings) = \frac{earnings}{r}$$
Question 2:

You could say that the cost of acquiring Targetco is the difference between the cash payment and the value of Targetco as a separate company:
$$Cost = cash\ paid\ out - Target\ co.value$$

This is the merger's NPV for acquiring company:
$$NPV = economic\ gain - cost$$

Mergers financed by stock

Question 1:

The economic gain to the merger is the present value of the extra earnings:
$$Economic\ gain = PV(increased\ earnings) = \frac{earnings}{r}$$
Question 2:
$$Cost = value\ of\ shares\ issued - Target\ co.value$$

This is the merger's NPV for acquiring company:
$$NPV = economic\ gain - cost$$

NOTE: There is a key distinction between cash and stock for financing mergers. If cash is offered, the cost of the merger is not affected by the size of the merger gains. If stock is offered, the cost depends on the gains because the gains show up in the post merger share price, and these shares are used to pay for the acquired firm.

21.5 THE MARKET FOR CORPORATE CONTROL

The market for corporate control: the mechanisms by which firms are matched up with management teams and owners who can make the most of the firm's resources. There are four ways to change the management of a firm:

METHOD 1: PROXY CONTESTS

When a group of investors believe that the board and its management team should be replaced, they can launch a proxy contest. A proxy contest is a takeover attempt in which outsiders compete with management for shareholders' votes. Also called proxy fight.

<u>Problems:</u> The problem with proxy fights is that they can cost millions of dollars. Dissidents who engage in them must use their own money, but management can draw on the corporation's funds and lines of communication with shareholders to defend itself.

METHOD 2: TAKEOVERS
If the management of one firm believes that another company's management is not acting in the best interests of investors, it can go over the heads of that firm's management and make a tender offer directly to its stockholders.

- If successful: The new owner can install its own management team.
- During these contests the courts act as a referee to see that the contests are conducted fairly

Defense mechanisms

1. Shark repellent: Amendment to a company charter made to forestall takeover attempts
   For example, merger must be approved by a supermajority of 80% instead of 50%
2. Poisson pill: Measure taken by a target firm to avoid acquisition (makes the firm unappetizing).
   For example, the right of existing shareholders to buy additional shares at an attractive price if a bidder acquires a large holding.
3. Poisson puts: Bondholders can demand repayment if ownership is changing
4. White knights: Friendly potential acquirer sought by a target company which is threatened by an unwelcome suitor
5. Golden parachutes: The management can leave with a big bonus if there is a change in control
6. Customer assurance program: Customers get money back if acquirer reduces customer support

METHOD 3: LEVERAGED BOYOUTS
Leveraged buyout (LBO): A group of shareholders (or management – MBO) buys the firm and it is to a large extent financed with debt

- Some, perhaps all, of this debt is junk, below investment grade
- The shares of the LBO no longer trade on the open market (the firm goes private)
- The remaining equity is held by a private equity
- When group led by management, the LBO is called management buyout (MBO) (fairly common)

Potential sources of value in LBOs

- Leverage creates stronger incentives and reduces taxes
- Other stakeholders (bondholders, employees) suffer, which may explain part of shareholders gain Other stakeholders: Bondholders are the obvious losers, since they through their debt was well-secured
- Leverage and incentives: It's hard to measure the payoff from better incentives, but there is some evidence of improved operating efficiency in LBOs
- Free cash flow: The free-cash-flow theory of takeovers is basically that mature firms with a surplus of cash will tend to waste it. An LBO will force these companies on a diet
- Saves some of the costs related to being a listed firm (including focusing too much on short term results)

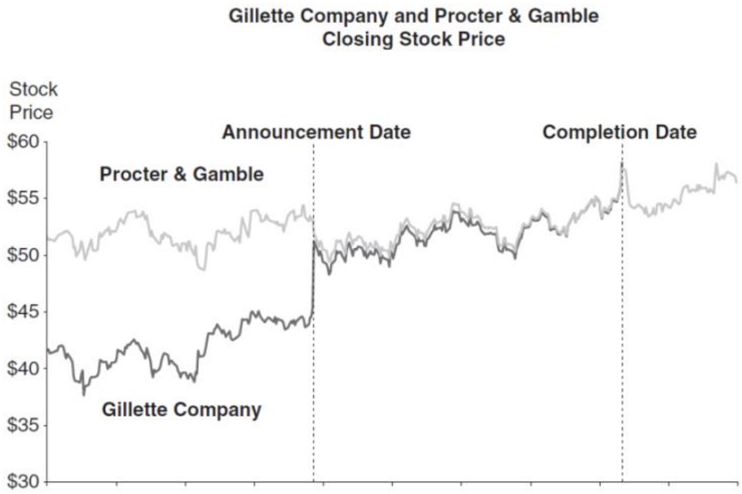
METHOD 4: DIVESTITURES, SPIN-OFFS, AND CARVE-OUTS

- **Divestiture:** When a firm sells some of the assets to another entity
- **Spin Off:** The process where a business separates the ongoing operations of a specific unit into two parts and gives the shareholders of the original parent firm shares in the two parts. The new unit and parent function now as separate entities.
- **Carve Outs:** Similar to a spin off, but the carve out issues shares of the new firm to the public (instead of existing shareholders)
- *In short, part of the firm becomes a new identity with new owners (and management)*

21.10 MERGERS IN PRACTICE

Short term effects

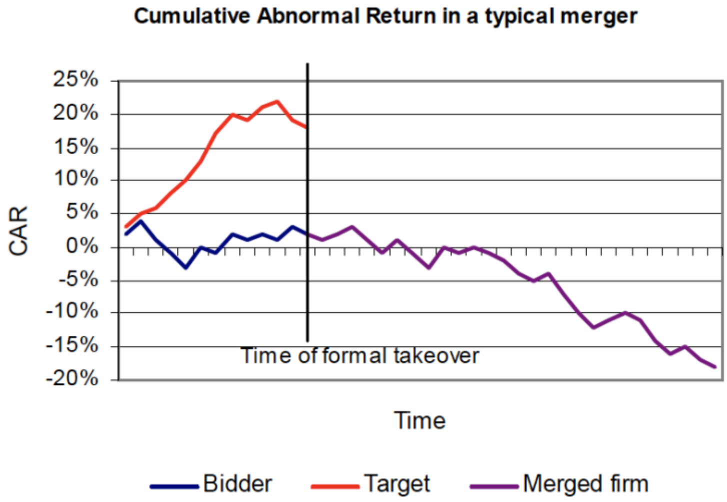
All the gains seem to go to the target company:



Common short-term effects for target and acquirer:

- Price of target: Stock price rises
- Price of acquirer: Stock price is the same or even decreases

Long term effect



Common long-term effect of mergers: Debated (probably why book does not mention this).
Why negative long-term effect?

- Correction? Abnormally high stock prices of both acquirer (making shares a valuable currency) and/or target (mergers frequent in bull markets)
- Overbidding?
- Unexpected internal difficulties? Distract managers from maximizing value of firm
- Bidders overstate own abilities pre-merger
- Managers' incentive not to act in shareholders' interest

Mergers in practice – motives
If mergers on average have a negative LR effect, why bid?

- Managers believe that they can beat the odds
- Believe they can boost performance of inefficient firms. But empirically unprofitable targets do not seem to be singled out.
- Hubris hypothesis: managers over-estimate own ability (everybody believes they are better than average!). "Triumph of hope over experience"

Managers act against shareholders best interest?

- Principal-agent problem. Leads to empire-building.
- Power, prestige, lower threat of takeover for big firms and stable profits means relaxation instead of continuous profit-maximization

Financial intermediaries encourage mergers?

- "Independent" analysts receive transaction costs

Benefits & costs in practice

Who usually benefits from the merger?	Who usually loses from the merger?
Shareholders of the target Lawyers & brokers The executives of the acquiring firm	Shareholders of the acquirer due to overpayment Executives of the target All employees due to restructuring

EXERCISE

- A firm named Macrohard is bidding to take over a firm called Skipe.
- Macrohard has 7,200 shares outstanding selling at £24 per share.
- Skipe has 6,400 shares outstanding selling at £8 per share.
- The estimated synergy gains from merger are £36,000.
- Suppose that the merger takes place through an exchange of stock, where Macrohard issues 0.333 of its shares for every Skipe share acquired.
- What will be the price per share of the merged firm?

M: 7200 shares * 24 pounds
S: 6400 shares * 8 pounds
Gains: 36,000 pounds
0.333 M share = 1 S share → $\underbrace{0.333 * 6400}_{2131} = 1 * 6400$

M shares = 2131 + 7200

$$Price\ of\ merged\ firm = \frac{Market\ value\ of\ firm}{\#outstanding\ shares}$$

$\Leftrightarrow$

$$Price\ of\ merged\ firm = \frac{(7200 * 24) + (6400 * 8) + 36{,}000}{7200 + 0.333 * 6400} = \mathbf{27.9\ per\ share}$$

The Economist (E5)

"M&As often disappoint" ~ Bosses love them; shareholders rue them

Great temptation to merge for CEOs

- Investment bankers eager to offer deals
- Appears as decisive action & easier than coming up with new product
- Keeps activist hedge funds (big, active shareholders demanding return) off management's back
- Greater CEO salary since the CEO will be in charge of a larger company
- CEO arguments: Costs will be cut, benefits from a wide range of products, many synergies, and so on.

But acquirers' shares underperform

- Understandable, as profit margins, ROIC & ROE all fall, EPS grows less quickly, debt and interest rises
- Clashes of culture as systems are hard to integrate
- Instead of 2+2=5 we get 2+2=3.5

Empirical warning signals of unsuccessful merger

- The faster growth before, the worse performance afterwards
- Large deals perform worse
- All-share deals, as opposed to cash deals, perform worse
- Companies with a lot of cash still tend to be bad at acquisitions

So why offer?
- Executives' self-confidence
- Believe they can defy odds

Who can, and/or is likely, to stop it?
- The board of the acquirer
- Regulators
- Populism and protectionism: Governments less willing to sell national champions to foreigners

Conclusion:
People get very caught up on the price, and most deals falls through since firms disagree on the price. 55% of major acquisitions are later divested.
Reverse synergy: Occurs when splitting up previous M&A. This is sometimes a good idea since it can increase value for both of the firms.

Topic 11: International financial management

Chapter 22: International financial management

22.1 FOREIGN EXCHANGE MARKETS

Exchange rate
Amount of one currency needed to purchase one unit of another.
- Indirect quote: The number of DKK you can buy for a dollar
- Direct quote: The number of dollars that it costs to buy one DKK

Spot rate of exchange (S)
Exchange rate for an immediate transaction. Exchange rates are generally quoted against the dollar.
- Appreciate: When you need less of the foreign currency to buy one dollar
- Depreciate: When you need more of the currency to buy one dollar

Forward exchange rates (f)
Exchange rate agreed upon today for a future transaction → You are entering a forward contract. The forward exchange rate is not usually the same as the spot rate. If the exchange rate is higher than the spot rate it is said to trade at a forward discount. If it is lower, then it trades at premium (you can buy fewer of the currency for a dollar).

EXAMPLE
The yen spot price is 111.715 yen per dollar and the 1-year forward rate is 108.173 yen per dollar. What is the premium/discount?
Calculation depends if it is a direct or indirect quote:

Direct: $\frac{Forward\ price - Spot\ price}{Spot\ price} = premium\ or\ discount$

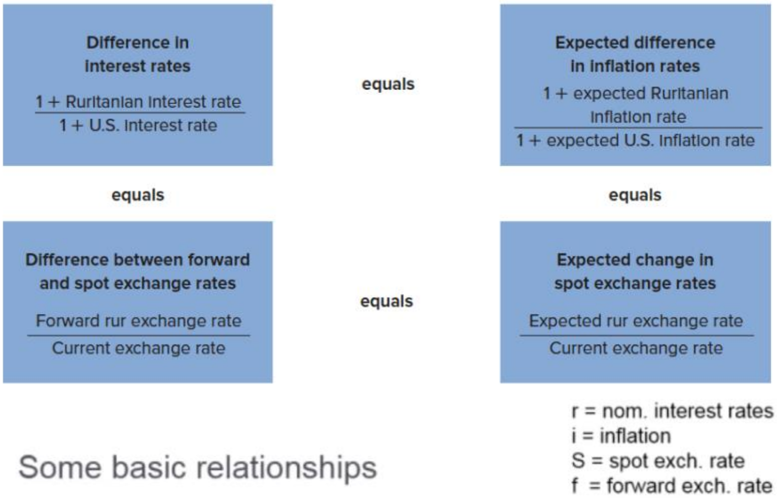
Indirect: $\frac{Spot\ price - Forward\ price}{Forward\ price} = premium\ or\ discount$

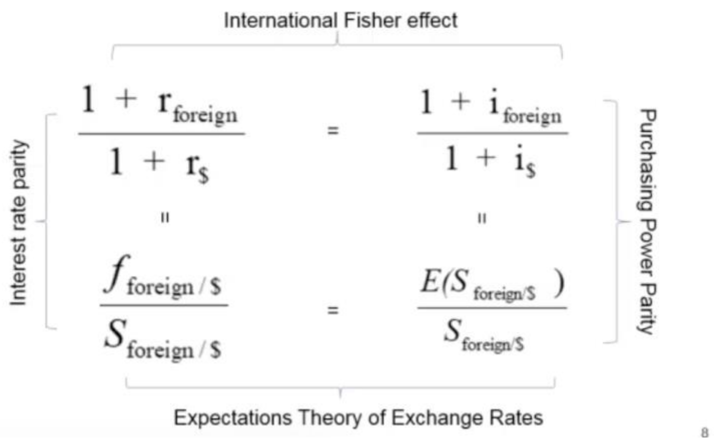
Our example is indirect:

$$\frac{111.715 - 108.173}{108.173} = 3.27\%$$

Conclusion: The yen is trading at a 3.27% forward premium relative to the dollar. OR the dollar is trading at a 3.27% forward discount, relative to the yen.

22.2 SOME BASIC RELATIONSHIPS





Some simple theories linking spot and forward exchange rates, interest rates, and inflation rates.

$\frac{1 + r_{foreign}}{1 + r_{\$}}$	$\frac{1 + i_{foreign}}{1 + i_{\$}}$
$\frac{Forward_{foreign}}{Spot_{foreign}}$	$\frac{E(S_{foreign})}{Spot_{foreign}}$

Exchange rates and inflation

Law of one price: Theory that prices of goods in all countries should be equal when translated to a common currency, or, more generally, that two assets providing the same cash flows cannot sell for different prices.

- However, the law doesn't hold exactly. If a price is higher one place than another it is usually because the gain would not cover the costs of transporting the good and making a profit.

1. **Purchasing power parity (PPP)**

Weaker version of the law of one price.
Theory that the cost of living in different countries is equal and exchange rates adjust to offset inflation differentials across countries.

Expected difference in inflation rates

$$\frac{1 + \text{expected Ruritanian inflation rate}}{1 + \text{expected U.S. inflation rate}} = \frac{1.06}{1.01} = 1.05$$

equals

Expected change in spot exchange rates

$$\frac{\text{Expected rur exchange rate}}{\text{Current exchange rate}} = \frac{105}{100} = 1.05$$

The expected exchange rate is found such that in one year 106 rurs will buy the same as 1.01 dollars, and $1 sill have the same purchasing power as:

$$RUR100 * \frac{1.06}{1.01} = 105$$

Real and nominal exchange rates

Nominal exchange rates tell you how many euros or yen or pounds you can buy for your dollar. Real exchange rates measure the quantity of goods you can buy for that dollar in Europe or Japan or the United Kingdom.

2. **Inflation and interest rates**

What can explain differences in nominal interest rates? The nominal rate of interest is higher in Ruritania than in the United States, but if the inflation rate is also higher, then the real rates of interest may be much closer than the nominal rates:

$$Real\ US\ interest\ rate = \frac{1 + nominal\ interest\ rate}{1 + inflation\ rate} - 1$$

$\Leftrightarrow$

$$= \frac{1.03}{1.01} - 1 = 1.98\%$$

And:

$$Real\ Ruritanian\ interest\ rate = \frac{1.081}{1.06} - 1 = 1.98\%$$

This is the same as:

$$\frac{1 + r_{\$}}{1 + i_{\$}} = \frac{1 + r_{foreign}}{1 + i_{foreign}}$$

Rearranging, we get:

Difference in interest rates

$$\frac{1 + \text{Ruritanian interest rate}}{1 + \text{U.S. interest rate}} = \frac{1.081}{1.03} = 1.05$$

equals

Expected difference in inflation rates

$$\frac{1 + \text{expected Ruritanian inflation rate}}{1 + \text{expected U.S. inflation rate}} = \frac{1.06}{1.01} = 1.05$$

International Fisher effect: Theory that real interest rates in all countries should be equal, with differences in nominal rates reflecting differences in expected inflation.

3. **The forward exchange rate and the expected spot rate**

Expectations theory of exchange rates: Theory that the expected spot exchange rate equals the forward rate:

Difference between forward and spot exchange rates

$$\frac{\text{Forward rur exchange rate}}{\text{Current exchange rate}} = \frac{105}{100} = 1.05$$

equals

Expected change in spot exchange rate

$$\frac{\text{Expected rur exchange rate}}{\text{Current exchange rate}} = \frac{105}{100} = 1.05$$

On average (since the prediction is not always perfect), the forward price at which it agrees to exchange currency will equal the eventual spot exchange rate, no better but no worse.

4. **Interest rates and exchange rates**

Interest rate parity means that covered interest rates are the same in all major currencies. A financial manager who attempts to borrow in currencies with low interest rates can profit only by taking a bet on future exchange rates.

Interest rate parity (IRP): Theory that forward premium equals the interest rate differential (it always hold).

- You cant assume that it is cheaper to borrow in a currency with a low nominal interest rate
- Exchange will eventually adjust
- A failure to understand this has made whole countries collapse

Difference in interest rates

$$\frac{1 + \text{Ruritanian interest rate}}{1 + \text{U.S. interest rate}} = \frac{1.081}{1.03} = 1.05$$

equals

Difference between forward and spot exchange rates

$$\frac{\text{Forward rur exchange rate}}{\text{Current exchange rate}} = \frac{105}{100} = 1.05$$

22.3 HEDGING CURRENCY RISK

Firms with international operations are subject to currency risk. As exchange rates fluctuate, the dollar value of their revenues or expenses also fluctuates. There are two types of risk:

Transaction risk

- Transaction risk: Arises when the firm agrees to pay or receive a known amount of foreign currency.
    - If the currency appreciates rapidly over this period, the machinery will cost more dollars than expected. This can be hedged through forwards.
    - However, the currency can also depreciate which makes the spot market more cheap
- The cost of hedging: The difference between the forward rate and the expected spot rate when payment is due.

- *E.g.: An importer in US are receiving imported goods in six months from another country. He can hedge his risk by buying this currency forward for 6 months since he will then lock in the exchange rate.*
- *OR E.g.: The importer could borrow US dollars, exchange them into the foreign exchange rate and then put them in a foreign bank deposit. When he reaches payment, he can then use the deposits to pay (The exactly same as buying forward of the foreign exchange rate)*

Economic risk

If firms do not owe or owed foreign currency, they can still be affected by currency fluctuations. Exporters can have economic exposure to the exchange rate because the exchange rate change affected their competitive position.

- Operational hedging: Balancing production closely with sales. *E.g. 35% of Nestlé's sales are in the euro area, but so are 35% of its production costs.*
- Taking opposite positions: *E.g. if you owe 100 yen at the end of the year, then convert dollars into yen and invest in Japanese bank until the end of the year*

22.4 INTERNATIONAL CAPITAL BUDGETING

NPV for foreign investments

You cannot compare the project's return measured in one currency with the return that you require from investing in another currency. If the opportunity cost of capital is measured as a dollar-denominated return, cash flows should also be forecast in dollars.

Discounting

To translate the project into the rur instead of dollar, they need the forward exchange. It is found by:

$$Forward\ rate\ for\ Y1 = spot\ rate\ Y0 * \frac{1 + rur\ interest\ rate}{1 + dollar\ interest\ rate}$$

$\Leftrightarrow$

$$= RUR100/USD1 * \frac{1.081}{1.03} = RUR\ 104.95/USD1$$

Now we can find each year's exchange rate:

Year	Forward Exchange Rate (RUR per USD)
1	$100 \times (1.081/1.03) =$ RUR104.95/USD1
2	$100 \times (1.081/1.03)^2 =$ RUR110.15/USD1
3	$100 \times (1.081/1.03)^3 =$ RUR115.60/USD1
4	$100 \times (1.081/1.03)^4 =$ RUR121.33/USD1
5	$100 \times (1.081/1.03)^5 =$ RUR127.33/USD1

Converting the rur into dollars:

Year:	0	1	2	3	4	5
Cash flow (millions of rurs)	−380	100	125	150	175	200
Forward exchange rate (rurs to the dollar)	100	104.95	110.15	115.60	121.33	127.33
Cash flow (millions of dollars)	− 3.8	0.9528	1.1348	1.2976	1.4424	1.5707

Now the manager discounts these dollar cash flows at the 13% dollar cost of capital:

$$\text{NPV} = -3.8 + \frac{.9528}{1.13} + \frac{1.1348}{1.13^2} + \frac{1.2976}{1.13^3} + \frac{1.4424}{1.13^4} + \frac{1.5707}{1.13^5}$$

$$= \$.568 \text{ million, or } \$568{,}000$$

Investment decision and risk

- Notice that the analysis is based on forward exchange rates.
- Also, firms' own predictions about future changes in exchange rates are irrelevant → firms can hedge their exposure.
- The project must be able to stand on its own. It would be foolish for a firm to accept a poor project just because it forecasts an improvement in the exchange rate
- Foreign projects are usually evaluated in domestic currency

Political risk

Managers worry that a government will change the rules of the game, breaking a promise or an understanding, after the investment is made.
Note: Do not adjust the discount rate if you adjust for political risk instead (i) adjust expected cash flows or (ii) add a risk premium to the cost of capital.

CAPM in international markets

When working with international projects, you might want to adjust your CAPM model:

- Local CAPM: Using a broad-based local index proxying for the home country market portfolio
- Global CAPM: Using a broad-based global index proxying for the collective wealth of countries

Topic 12: Options

Chapter 23: Options

23.1 CALLS AND PUTS

Derivatives

Securities whose payoffs are determined by the values of other financial variables (such as the price of a stock). An instrument deriving its value from another underlying instrument.
Examples of underlying instruments: Shares, bonds, interest rates, foreign currency, commodities, etc.

Call option

Right to buy and asset at a specified exercise price on or before the expiration date.

Stock Price at Expiration	Value of Call at Expiration
Greater than exercise price	Stock price – exercise price
Less than exercise price	Zero

E.g.: if you buy an Alphabet stock with an expiration date in June and an exercise price of $750, you have the right to buy the stock at a price of $750 anytime until June. If the shares rise to $820 before June, then you will buy a stock for $750 worth $820 = you have earned $70 (minus the cost of the option).

Put option

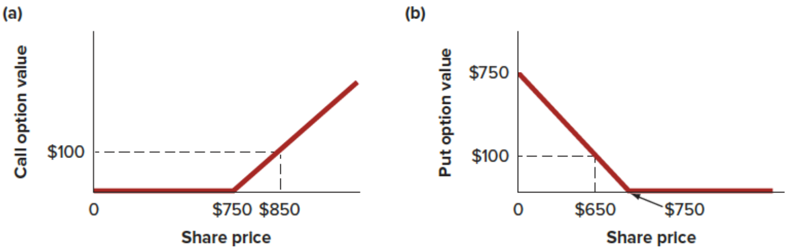
Right to sell an asset at a specified exercise price (strike price) on or before the option's expiration date.

Stock Price at Expiration	Value of Put at Expiration
Greater than exercise price	Zero
Less than exercise price	Exercise price – stock price

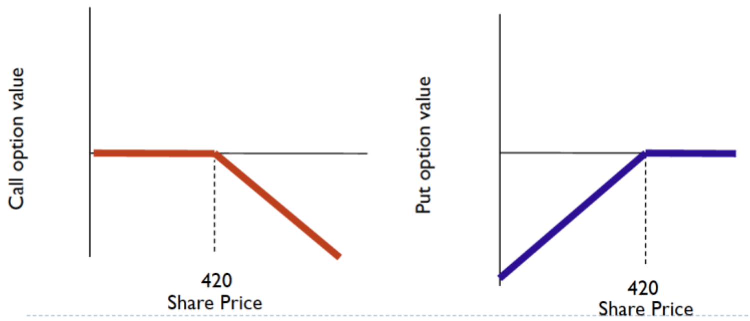
E.g. Alphabet as an example:

Stock Price:	$650	$700	$750	$800	$850
Call value	0	0	0	$50	$100
Put value	$100	$50	0	0	0

Values of call options and put options on option expiration date.



Selling calls and puts: The seller's loss is the buyer's gain and vice versa (the value graph is just the opposite as the one seen from the buyer side).



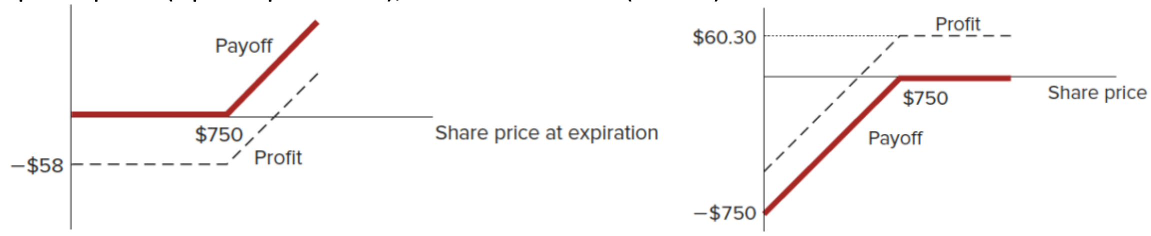
Payoff protection: If you are holding a stock, and you are afraid that the stock will drop in price, you can buy puts: your losses will be limited because the put gives you the right to sell your stock for the $750 exercise price.

Payoff diagrams are not profit diagrams

Rights and obligations:

	Buyer	Seller
Call option	Right to buy asset	Obligation to sell asset
Put option	Right to sell asset	Obligation to buy asset

Option price (option premium), which the seller (writer) receives. Profit:



The price of a put (Put-call parity)

There is a fundamental relationship between the price of a call and the price of a put:

$$Price\ of\ stock + price\ of\ put = Price\ of\ call + PV\ of\ exercise\ price$$

You get excatly the same payoff from:

1. Owning a stock and put option on the stock
2. Owning a call option on the stock and investing the present value of the exercise price in a bank deposit.

Option properties

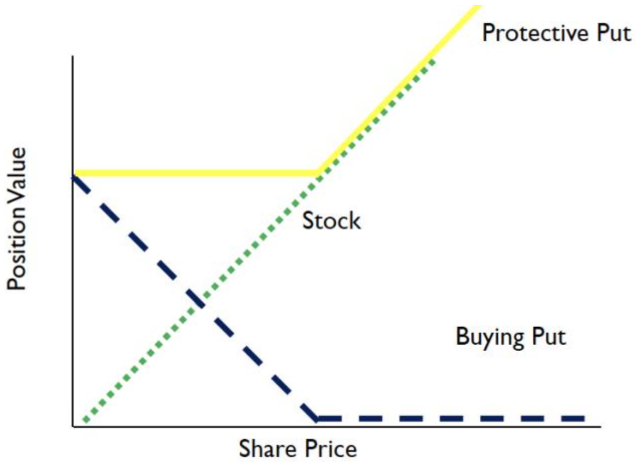
Reduce/hedge risk:

- Possibility of gaining from favorable price movements, but not lose on unfavorable ones
- Comes at a price – the price of the option (option premium)

An insurance on the value of portfolio, i.e. a safety net against e.g. drop in prices

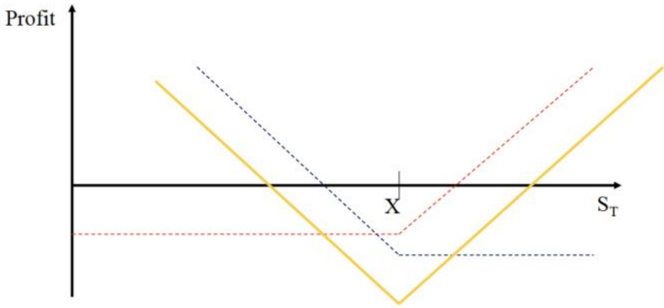
- For example, you can ensure that your portfolio will not go below a certain value
- At the same time you have an unlimited upside potential
- This is great – and hence priced accordingly

Protective put



The overall position: Adding up the green and the blue line = the yellow line.
The put exercise price (horizontal yellow) becomes your lower bound.

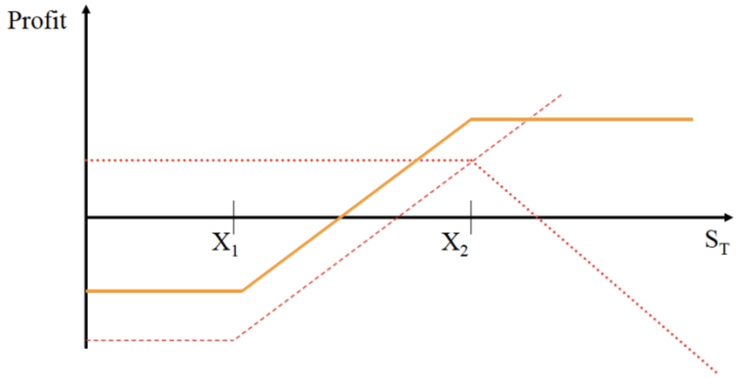
Straddle: When you buy both a call and a put. Is usefull when you bet on high volatility but you don’t know which direction the stock will go.



- Red line: Call option

- Blue line: Put option (notice: more expensive than the call since the blue line is further down).
- Yellow line: The profit line. The lowest point is where your loss is the call and put premium.
- S_T: The stock price.

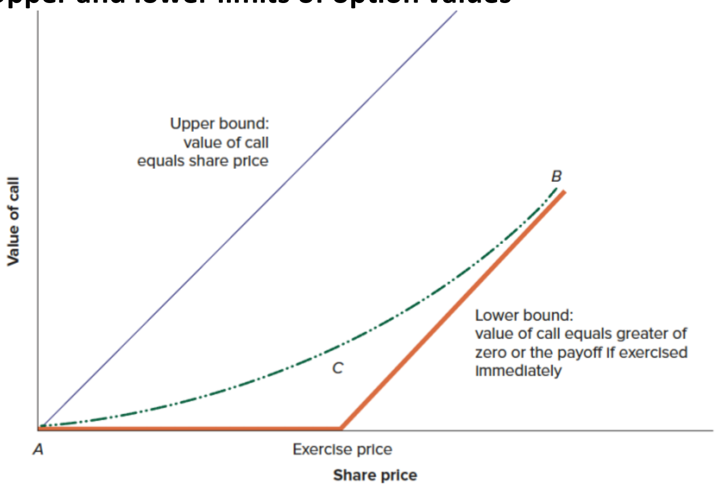
Bull spread: Buying a call in a stock at exercise price X_1 and issuing (selling) a call in the same stock with the same expiration date, but a higher exercise price, X_2.



Long position: When you are the buyer.
Short position: When you are the seller (writer).
S (stock price), X (exercise price)

	Call	Put
In the money (making money)	$S > X$	$S < X$
At the money	$S = X$	$S = X$
Out of the money (losing money)	$S < X$	$S > X$

23.2 WHAT DETERMINES OPTION VALUES?
Upper and lower limits of option values



Value of a call before its expiration date (dashed line).
- The value depends on the stock price. The call is always worth more than its value if exercised now (heavy orange line)
- Lower limit:

$$Lower\ limit\ on\ value\ of\ call\ option = the\ greater\ of\ 0\ or\ (stock\ price - exercise\ price)$$

- It is never worth more than the stock price itself (blue line).

Stock Price at Expiration	Stock Payoff	Option Payoff	Extra Payoff from Holding Stock Rather than Option
Greater than $750	Stock price	Stock price – $750	$750
Less than or equal to $750	Stock price	$0	Stock price

The determinants of option value

- The value of the call option increases as the stock price increases. It also increases with both the rate of interest and the time to expiration.
    - Point a: When the stock is worthless, the option is worthless
    - Point b: When the stock price is very high, the option price approaches the stock price less the PV of the exercise price.
    - Point c: The option price always exceeds its minimum value (except at expiration or when the stock price is zero).

Price of options:

The probability of large stock price changes during the remaining life of an option depends on two things: (1) the variability of the stock price per unit of time and (2) the length of time until the option expires.

- You would like to hold an option on a volatile stock.
- You would like to hold an option with a long life ahead of it because that longer life means that there is more opportunity for the stock price to change.
- Conclusion: The value of an option increases with both the variability of the share price and the time to expiration.

	Effect on option price if factor rises	
	Call	Put
Stock price (S)	↑	↓
Exercise price (X)	↓	↑
Stock volatility (σ)	↑	↑
Time to mat. (T)	↑	↑
Interest rates (r)	↑	↓

23.3 SPOTTING THE OPTION

Options on real assets

When a project is flexible or generates new opportunities for the firm, it is said to contain real options. Real options are options to invest in, modify, postpone or dispose of a capital investment project.

- The option to expand: Many capital investment proposalt include an option to expand in the future
    - Option to expand: if the asset presents future benefits, i.e. it is a call option.
    - Exercise price is usually the required additional investments, underlying asset is the value of the cash flows to the firm.

- The option to abandon: If you are offered a project in a future, you will in the meantime also have the option to abondon that project up until the project will start
  - Option to abandon: the value of not having to undertake a project immediately, i.e. a put option.
  - Exercise price is usually the scrap value of assets, underlying asset is the value of the cash flows to the firm.

Options on financial assets
- Executive stock options: Compensation to executives in the form of options
- Warrents: A long-term call option on the company's stock and the right to buy shares from a company at a stipulated price before a set date
- Convertible bonds: A close relative of the bond-warrant package. It is a bond that the holder may exchange for a specified amount of another secutiry (e.g. common stock)
- Callable bond: Bond that may be repurchased by the issuing firm before maturity at a specified call price

The Economist (E6)
"When you have options, volatility is your friend"
A license to operate an oil field
- Costs \$90 to retrieve each barrel of oil, currently sells for \$70
- License still valuable as oil prices fluctuate, i.e. uncertainty, the price may go above \$90 in future
- A real option, with characteristics of a financial call option

Volatility typically disliked
- But good for option values
- The more volatility, the higher chance that an out-of-the-money option becomes in-the money

Estimates of volatility are central to option pricing
- But can also solve for volatility, given price of option
- This is how the VIX (volatility index) is obtained, i.e. implied volatility from options written on the S&P500 stock index

B-S assumes known and time-constant volatility
- But in reality, volatility clusters and spikes (note: there exist models that capture this)

Topic 13: Risk management
Chapter 24: Risk management
24.1 WHY HEDGE?
Arguments against hedging
- Hedging is a zero-sum game. A company that hedges a risk does not eliminate it. It simply passes the risk on to someone else.
- Investors' do-it-yourself alternative. Companies cannot increase the value of their shares by undertaking transactions that investors can easily do on their own.
- Hedging is normally costly

- Hedging cannot increase the value of investors' shares

Arguments for hedging

- Decreases the probability of financial distress (=> lower expected distress cost & higher debt capacity)
- Financial planning easier
- Easier to disentangle the source of a failure (back luck vs. poor management)
- Allows managers to focus on operations rather than being afraid of losing their job!

24.2 REDUCING RISK WITH OPTIONS

Managers regularly buy options on currencies, interest rates, and commodities to limit their downside risk

24.3 FUTURE CONTRACTS

Future contract

Exchange-traded promise to buy or sell an asset in the future at a prespecified price (This is no longer an option but an obligation to deliver an asset at a specified price).
No money changes hands when a futures contract is entered into. The contract is a binding obligation to buy or sell at a fixed price at contract maturity.

Profits

$$Profit\ to\ seller = initial\ futures\ price - ultimate\ market\ price$$
$$Profit\ to\ buyer = ultimate\ market\ price - initial\ futures\ price$$

The profits on the futures contract offset the risk surrounding the sales price of wheat and lock in total revenue equal to the futures price:

	Cash Flow
Sale of wheat	Ultimate price of wheat
Futures profit	Futures price – ultimate price of wheat
Total	Futures price

E.g.: if the futures price is originally $5 and the market price of wheat turns out to be $5.50, the farmer delivers, and the miller receives the wheat for a price $.50 below market value. The farmer loses $.50 per bushel and the miller gains $.50 per bushel as a result of the futures transaction.

24.4 FORWARD CONTRACTS

Forward contract

If the terms of a futures contract do not suit your particular needs, you may be able to buy or sell a forward contract. It is an agreement to buy or sell an asset in the future at an agreed price.
Forward contracts are custom-tailored futures contracts. You can write a forward contract with any maturity date for delivery of any quantity of goods.

24.5 SWAPS

Interest rate swaps

Agreement by two counterparties to exchange one stream of cash flows for another. Is used to hedge interest rate exposure.

The firm will pay or "swap" a fixed payment for another payment that is tied to the level of interest rates. Thus, if rates do rise, increasing the firm's interest expense on its floating-rate debt, its cash flow from the swap agreement will rise as well, offsetting its exposure.
E.g.:

Computer Parts currently pays the LIBOR rate on its outstanding bonds (the arrow on the left). If the firm enters a swap to pay a fixed rate of 5% and receive a floating rate of LIBOR, its exposure to LIBOR will cancel out and its net cash outflow will be a fixed rate of 5%.

	LIBOR Rate		
	4.5%	5.0%	5.5%
Interest paid on floating-rate bonds (= LIBOR × $100 million)	$4,500,000	$5,000,000	$5,500,000
+ Cash payment on swap [= (.05 − LIBOR) × notional principal of $100 million]	500,000	0	−500,000
Total payment	$5,000,000	$5,000,000	$5,000,000

Currency swaps
Currency swaps allow firms to exchange a series of payments in dollars (which may be tied to a fixed or floating rate) for a series of payments in another currency (which may also be tied to a fixed or floating rate).

26.6 DERIVATIVES INNOVATIONS

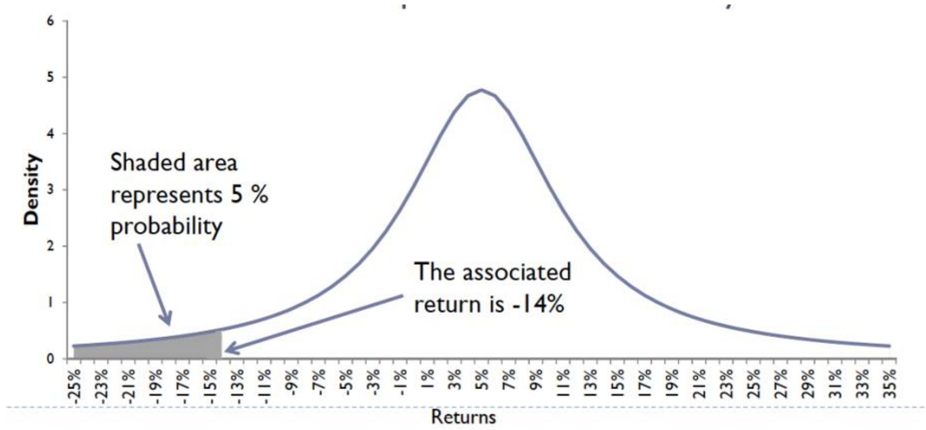
- Continuous, rapid innovation
    - Very hard to regulate due to complexity and pace
    - Clearing and settlement play a big role (and IT)
- Not nearly an exhaustive list!
    - Some contracts a success – other fail and disappear.
- Example 1: Weather derivatives
    - A TV network may want to hedge the risk of a
    - World Series game being rained out and thus they forego advertising income
- Example 2: Credit Default Swaps (CDS)
    - Payment in exchange for payoff if a bond goes into default
    - Insurance against bankruptcy
    - Controversy: betting on bankruptcy a self-fulfilling prophecy? (or at least increases probability?)

RISK MEASUREMENT: VALUE-AT-RISK (NOT IN BOOK)
But how to measure it? (risk measurement)

- Standard deviation is the simplest way and the best way to measure risk

Value at Risk (VaR) is a statistical way of measuring risk

- VaR returns an estimated $ value (or % of portfolio)
- Definition: The worst loss we can have for a given time horizon and for a given level of significance (probability)
- *Example: A portfolio where you can state (with 95% confidence) that it will not lose more than 1 million in value over the next year*



"What loss level is such that we are X% confident it will not be exceeded in N business days?" For example, there is a 95% probability we will not lose more than 14% of our portfolio over the next year.

Advantages	Disadvantages
• It captures an important aspect of risk in a single number • It is easy to understand • It asks the simple question: "How bad can things get?"	• A lot can change in the tail when we change the time period • To get around this, one can assume normality (but also problematic!) • Can be a little complicated to calculate

Calculation
This is hard to calculate since you want to illustrate a future probability and returns on stocks is not normally distributed.

- Historical simulation
- Variance-covariance method
- Monte Carlo
- Extreme Value Theory (EVT) (This gives you the highest VaR figure)
- Note also extensions like Expected Shortfall (ES)

Topic 14: Course overview and Q&A

Other valuation methods
Enterprise value (V) multiples:

$$EBIT\ Multiple = \frac{V}{EBIT}$$

Or

$$EBITDA\ Multiple = \frac{V}{EBITDA}$$

Equity multiples:

$$\frac{P}{E} = \frac{Price}{Earnings}$$

Or

$$\frac{PV}{BV} = \frac{Price}{Book\ Value}$$

EXAMPLE

In 2020 a privately held firm, Company A, was considering listing on the stock exchange (an IPO). An analysis included the following (€M):

Company A	2020	2021 (expected)	2022 (expected)
EBITDA	579	572	608
Net income (i.e. earnings)	42	93	119

A carefully conducted DCF valuation lead to:

- Enterprise Value (V) = €M 5,154
- Where Equity Value = €M 2,054 & Debt = €M 3,100 (totaling 5,154)

For a traded (relatively?) close competitor (Company B) we have the following information (€M)

Company B	2020	2021 (expected)	2022 (expected)
V/EBITDA	10.4	9.3	8.0
P/E (equity price/earnings)	23.2	18.5	13.5

Use multiples to calculate six different estimates of the value of company A

- 2 multiples and 3 dates for each => you can get 6 estimates

$$\frac{V_A}{EBITDA_A} = \frac{V_B}{EBITDA_B}$$

$\Leftrightarrow$

$$V_A = \frac{V_B}{EBITDA_B} * EBITDA_A$$

V_A = 10.4 x 579 = 6,022 based on 2020 numbers
V_A = 9.3 x 572 = 5,320 based on 2021 numbers
V_A = 8.0 x 608 = 4,864 based on 2022 numbers

The same can be done with the equity multiples, here you just need to add debt.

Comparing valuation methods

- The multiple method has one big assumption of the firms being the same, and there can easily be differences in firms.
- The values obtained by multiples are sensitive to timing issues, one-time events, and possible differences between project and peers
- In reality there are often differences among the DCF-based value and the peer comparison value → You must analyze the source of these differences.

$$f_{for/dom} = S_{for/dom}\left(\frac{1+r_{for}}{1+r_{dom}}\right)^t$$

$$PV = \frac{CF_1}{(1+r)^1} + \cdots + \frac{CF_t}{(1+r)^t}$$

Revenues
- Costs
- Depreciation

= Profit before taxes
- Taxes

= Profit after taxes

\+ Depreciation
± Inv. in fixed capital
± Inv. in working cap.
= Cash flow

$$PV = C\left[\frac{1}{r} - \frac{1}{r(1+r)^t}\right]$$

$$PV = \frac{CF_1}{r-g}$$

$$ROE \cdot plowback$$

$$r = r_f + \beta_{project}(r_m - r_f)$$

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

$$YTM$$

$$r_f + \beta_E(r_m - r_f)$$