Introduction to Finance

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Last weeks

- You know how to:
  - Compute the net present value of a project.

$$NPV = C_0 + \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + ... + \frac{C_T}{(1+r)^T} = \sum_{t=0}^{T} \frac{C_t}{(1+r)^t}$$

  - Which rules should be used to chose between projects.
    - NPV should be preferred to IRR or payback period when possible.
    - For mutually exclusive projects, pick the one with the highest NPV.
    - When resources are constrained, chose the projects that maximize total NPV.

  $\longrightarrow$ When you can found several different projects, compute the profitability index ($\frac{NPV}{Investment}$) to chose the most profitable ones.

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- In previous sessions we have used the r, the discount rate as given.
  - Easy to compute for riskless projects: it corresponds to the risk-free rate (*e.g.* U.S. government bonds).
  - More complicated for risky projects.
- In this session we will learn how to compute it.

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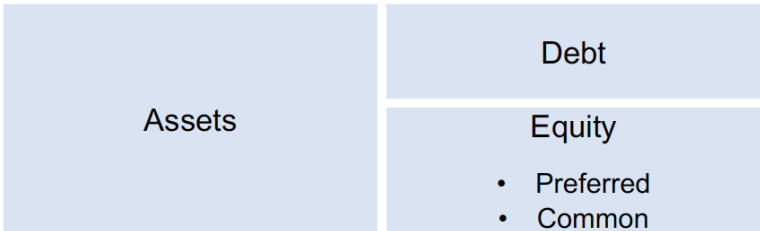
- In this session we will learn how to compute it.
- Don't forget: midterm net week.
  - Multiple-choice questions and exercises.
  - 1h30 max.

Valuing stocks

- The Capital Structure of a firm is a mix of liabilities to finance assets.



Valuing stocks

How are common stocks traded

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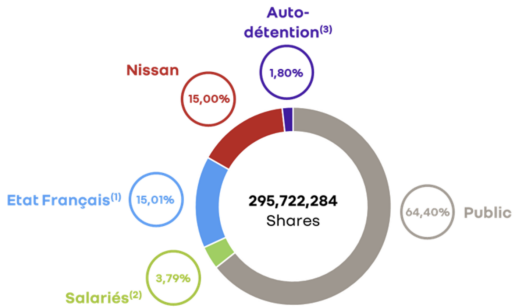

Valuing stocks

How are common stocks traded

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Principaux Actionnaires: Renault

Renault SA (FR0000131906)

Nom	Actions	%	Valorisation
Government of France	44 387 915	15,01 %	2 110 M €
Nissan Motor Co., Ltd.	44 358 343	15,00 %	2 109 M €
Renault SA Employee Stock Ownership Plan	11 198 833	3,787 %	532 M €
Renault SA	5 310 961	1,796 %	252 M €
Eleva Capital LLP	3 435 345	1,162 %	163 M €
Amundi Asset Management SA (Investment Management)	2 488 532	0,8415 %	118 M €
Magallanes Value Investors SA SGIIC	2 403 438	0,8127 %	114 M €
Vega Investment Managers SA	1 273 723	0,4307 %	61 M €
Crédit Mutuel Asset Management SA	932 847	0,3154 %	44 M €
OFI Invest Asset Management SA	849 817	0,2874 %	40 M €

Valuing stocks

How are common stocks traded

- A company like Renault has around 300 millions shares.

Exercice	Nombre de titres composant le capital social au 31 décembre	Dividende par action (en euros)
2015	295 722 284	2,40
2016	295 722 284	3,15
2017	295 722 284	3,55
2018	295 722 284	3,55

Valuing stocks

How are common stocks traded

- If Renault wants to raise new capital, it can borrow or or sell new shares to investors on the primary market.

- For now, most of action happens on the secondary market.

HISTORIQUE 5 JOURS

	23-09	24-09	25-09	26-09	27-09
DER.	38,97	39,43	38,93	39,85	41,29
VAR.	1,30%	1,18%	-1,27%	2,36%	3,61%
OUV.	38,47	39,63	39,08	39,40	40,05
+HAUT	39,07	39,95	39,42	40,31	41,59
+BAS	37,90	39,25	38,72	39,40	40,05
VOL.	767 087	970 389	1 075 883	1 489 579	1 729 992

Variation sur 5 jours : 5,95%

Valuing stocks

How are common stocks valued

- How to value these stocks?
- One can look at the quarterly balance sheet: in 2024Q2, the assets of Renault were 128bn euros.
- Renault's Equity was 31bn: this is the **book value** of Renault's equity.
- Does it represent the value of Renault?

Valuing stocks

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  - Not really because these assets are valued on a historical basis.
  - Renault market capitalization is 12bn!

Valuing stocks

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Valuing stocks

How are common stocks valued

- One can also look at the liquidation value: what business would immediately receive upon selling the asset on the open market.
  - Depreciated assets might still have a value on the market
  - Some assets (*e.g.* real estate) might have appreciated.
  - Useful for creditors but... does not take intangible assets into account for instance.

Valuing stocks

The determinants of stock prices

- Just as with the PV of an asset or a project, we use the Discounted Cash Flow (DCF) formula to value stocks.
- Cash flows are discounted by the return that can be earned in the capital market on securities of a comparable risk.
- $PV(\textit{stock}) = PV(\textit{expected future dividends})$

Valuing stocks

The determinants of stock prices

- The cash payment of holder of common stock is either a dividend or capital gains (difference between the price at which you bought the stock and the price at which you sell it).

- The expected rate of return on a stock is then: the expected dividend per share (DIV_1), plus the expected price appreciation ($P_1 - P_0$).

$$r = \frac{DIV_1 + P_1 - P_0}{P_0}$$

- Then, if you have a forecast of the future price, the future dividend and the expected return on similarly risky stocks, you can deduce the price.

$$P_0 = \frac{DIV_1 + P_1}{1 + r}$$

Valuing stocks

The determinants of stock prices

$$r = \frac{DIV_1 + P_1 - P_0}{P_0}$$

- r is the cost of equity capital: the expected return on other securities with the same risk.
- If a company offers a lower return than stock of similar risk, investors would sell stock because they can get a better return for no additional risk: $P_0 \searrow \Longrightarrow r \nearrow$
  - To check this just compute $\frac{\partial r}{\partial P_0}$

Valuing stocks

The determinants of stock prices

- How is P_1 determined?

$$P_1 = \frac{DIV_2 + P_2}{1 + r}$$

- We can then rewrite P_0

$$P_0 = \frac{1}{1 + r}\left(DIV_1 + \frac{DIV_2 + P_2}{1 + r}\right) = \frac{DIV_1}{1 + r} + \frac{DIV_2 + P_2}{(1 + r)^2}$$

- Investors might value the company today because they expect dividends in the future.

Valuing stocks

The determinants of stock prices

- Keeping this logic in mind for all the next periods, we get the general stock price formula or DCF formula:

$$P_0 = \sum_{t=1}^{\infty} \frac{DIV_t}{(1+r)^t}$$

- Despite being a source of cash, capital gains disappear from the formula.

- The share value is equal to the discounted stream of dividends per share.

Valuing stocks

The cost of equity capital

- Assume that we forecast a constant growth rate for company's dividends.

Valuing stocks

The cost of equity capital

- Assume that we forecast a constant growth rate for company's dividends.
  - Growing perpetuity.

Valuing stocks

The cost of equity capital

- Assume that we forecast a constant growth rate for company's dividends.
  - Growing perpetuity.
- What is P_0?
- $P_0 = \frac{DIV_1}{r-g}$ (for $r > g$).
- This also gives us an estimate of r:

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

- The expected return is the dividend yield + the expected rate of growth.

Valuing stocks

An application

- In the U.S. the price charged by electric and gas utilities are regulated by state commissions.
  - Keep consumer price low but have ensure the utilities earn their fair rate of return.
  - The fair rate is precisely proxied by r: the fair rate of return on equity for a public utility ought to be the cost of equity, that is, the rate offered by securities that have the same risk as the utility's common stock.
- Utilities are mature and stable companies for which the constant-growth DCF formula is expected to work well.

Valuing stocks

An application

- Company A sells its stock for 42.45$ per share with expected dividends of 1.68$ per share.
- From this we get the dividend yield:

Valuing stocks

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Valuing stocks

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- From this we get the dividend yield: $\frac{1.68}{42.45} = 0.04$
- We need to find g. Analysts expect an annual dividend growth of 6.1%.
- $r = \frac{DIV_1}{P_0} + g = 0.04 + 0.061 = 0.101$

Valuing stocks

An application

- Alternatively we can use the payout ratio that is the ratio of dividends to earning per share (EPS).
- Company A's payout ratio is expected to be 60%: each year the company pays 60% of its earnings in dividends and plows back 40% of it.
- Plowback ratio = 1- payout ratio = 0.4
- Company A's ROE is 11%.
  - Note that $ROE = \frac{EPS}{book\ equity\ per\ share}$
- By how much book equity increases?

Valuing stocks

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  - Note that $ROE = \frac{EPS}{book\ equity\ per\ share}$
- By how much book equity increases?
  - $0.4 \times 0.11 = 0.044$
  - Earnings and dividends will also increase by 4.4%.
- Therefore, $g = plowback\ ratio \times ROE$ is an alternative formula.

Valuing stocks

Limits of the DCF formula

- Regular future growth is at best an approximation that can only be computed with errors.

  $\longrightarrow$ Compute it for many similar companies and take an average to get a more reliable benchmark.

- Estimation with varying growth rates is possible: multi-stage DCF.
  - Young firms grow fast but it eventually stabilizes at lower rates (growth stocks *vs.* income stocks).
  - Decompose the DCF formula *e.g.* if dividend growth stabilizes after 3 years:
  - $P_0 = \frac{DIV_1}{1+r} + \frac{DIV_2}{(1+r)^2} + \frac{DIV_3+P_3}{(1+r)^3} = \frac{DIV_1}{1+r} + \frac{DIV_2}{(1+r)^2} + \frac{DIV_3}{(1+r)^3} + \frac{1}{(1+r)^3} \times \frac{DIV_4}{r-g}$

Valuing stocks

Exercise

- Company A has $DIV_1 = 0.5 \quad and \quad P_0 = 50$. Its book equity at year 1 is 10$.
- Plowback Ratio = 80% and ROE=25%.

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  - $r = \frac{.5}{50} + 0.2 = 0.21$

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- If g is constant what is r ?
  - $r = \frac{.5}{50} + 0.2 = 0.21$
  - The assumption that a firm can grow by 20% per year is too strong.
- From year 3, ROE = 16% and plowback ratio = 50%. It means that g drops to $0.5 * 0.16 = 0.08$.
- Compute r.

Valuing stocks

Exercise

	Year			
	1	2	3	4
Book equity	10.00			
Earnings per share, EPS				
Return on equity, ROE	.25	.25	.16	.16
Payout ratio	.20	.20	.50	.50
Dividends per share, DIV	.50			
Growth rate of dividends (%)	—			

Valuing stocks

Exercise

	Year			
	1	2	3	4
Book equity	10.00	12.00	14.40	15.55
Earnings per share, EPS	2.50	3.00	2.30	2.49
Return on equity, ROE	.25	.25	.16	.16
Payout ratio	.20	.20	.50	.50
Dividends per share, DIV	.50	.60	1.15	1.24
Growth rate of dividends (%)	—	20	92	8

Valuing stocks

Exercise

- We can use the multi-stage DCF formula.

$$P_0 = \frac{DIV_1}{1+r} + \frac{DIV_2}{(1+r)^2} + \frac{DIV_3 + P_3}{(1+r)^3} = \frac{DIV_1}{1+r} + \frac{DIV_2}{(1+r)^2} + \frac{DIV_3}{(1+r)^3} + \frac{1}{(1+r)^3} \times \frac{DIV_4}{r-g}$$

- In the case of our exercise:

$$P_0 = \frac{0.5}{1+r} + \frac{0.6}{(1+r)^2} + \frac{1.15}{(1+r)^3} + \frac{1}{(1+r)^3} \times \frac{1.24}{r-0.08}$$

- Trial and error gives $r \approx 0.099$

The Cost of Capital

The Weighted Average Cost of Capital (WACC)

- Given the capital structure, what is its cost?
- The Weighted Average Cost of Capital (WACC) is what you need.

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

  - E for equity and D for debt.
  - r_E the cost of equity.
  - r_D the cost of debt.
  - $E + D$ = Assets. $\frac{E}{E+D}$ and $\frac{D}{E+D}$ the financing weights.
  - T is the corporate tax rate.
- For an unlevered firm (*i.e* with no debt): $r_{WACC} = r_E$

The Cost of Capital

The Weighted Average Cost of Capital (WACC)

- If equity is split between common equity and preferred equity, then

$$r_{WACC} = \frac{C}{C+P+D} r_C + \frac{P}{C+P+D} r_P + \frac{D}{C+P+D}(1-T) r_D$$

- Preferred equity: hybrid between debt and equity. Preferred equity is more senior *i.e.* it has priority in the payment of dividends.

- It is generally associated with fixed dividends and comes without voting rights.

The Cost of Capital

The Weighted Average Cost of Capital (WACC)

- How should we compute financing weights?
  - Book values: reflect accounting and historical quantities.
  - Market values: forward-looking measures based on how the firm is valued by investors
- When the firm is tradeable and the market values observable, then use **market values** (this is what investors care about).

The Cost of Capital

The Weighted Average Cost of Capital (WACC)

- A company has:
  - Debt with a face value of 10m, trading at 95%
  - Book equity of 10m.
  - 1 million shares of common stock tradeing at 30$ per share.
  - What are the financing weights?

The Cost of Capital

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  - Debt with a face value of 10m, trading at 95%
  - Book equity of 10m.
  - 1 million shares of common stock tradeing at 30$ per share.
  - What are the financing weights?
    - $MVD = 0.95 \times 10 = 9.5m$
    - $MVE = 30 * 1m = 30m$
    - $MV = 39.5m$
    - Financing weights are therefore : 24.1 for debt and 75.9 for equity.

The Cost of Capital

The Weighted Average Cost of Capital (WACC)

- Central to the WACC are r_E and r_D.
- These are the cost of equity and debt at which current investors agreed to finance the firm.
- To do so, they had to forego other investment opportunities with similar risk.
- r_E and r_D already incorporate the compensation to investors for foregoing these alternative opportunities.
  - If it was not the case they wouldn't invest and r_E and r_D would increase to attract more investors and compensate them adequately.
  - If they were overestimated, more investors would come in and they would decrease.
- r_{WACC} is therefore the r we are after: the opportunity cost of capital.

The Cost of Capital

The Cost of Debt

- The firm's cost of debt r_D is the opportunity cost for an investor of holding debt from the firm.
- This rate must be set so that, given its price, creditors want to keep holding the firm's debt.
- r_D is such that: $P_{debt} = NPV_{debt}(r_D)$.
- The rate that equates the PV of the bond's future payment to today's market price is the **yield-to-maturity**.
  - This is the discount rate that sets the PV of the promised bond payments equal to the current market price of the bond
  - This is the rate an investor would earn by buying the bond at today's price and holding it to maturity.
- $r_D = YTM$

The Cost of Capital

The Cost of Debt

- Imagine an OAT that has a face value of 100, pays a 8.5% rate and has a market price of 120.44.

- The NPV is:

$$\frac{8.5}{1+y} + \frac{8.5}{(1+y)^2} + \frac{8.5}{(1+y)^3} + \frac{108.5}{(1+y)^4}$$

- The price is 120.44, so the YTD is defined as the rate for which:

$$P = NPV \Leftrightarrow 120.44 = \frac{8.5}{1+y} + \frac{8.5}{(1+y)^2} + \frac{8.5}{(1+y)^3} + \frac{108.5}{(1+y)^4}$$

- The YTM is 3% here. You can find it by trial and error.

The Cost of Capital

The Cost of Debt

- The cost of debt vis-a-vis investors is the YTM but this is not the actual cost of issuing debt.
- **Tax shield of debt** = interest expenses that are deductible for tax purposes = interest expenses $\times$ tax rate.
  - Tax expenses = (EBIT - Interest expenses) $\times$ Tax rate
- The firm pays interest to creditors but receive a tax break in return.
- Therefore the effective cost of debt for the firm is $r_D^* = r_D(1 - T)$

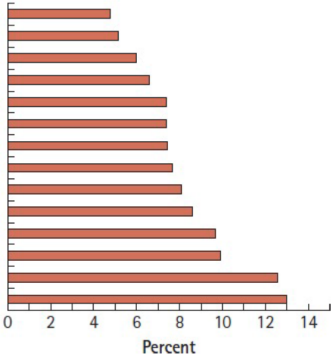
The Cost of Equity

The Cost of Equity

- r_E is simply the opportunity cost of holding equity from the firm.
- This is precisely what we computed at the beginning of the course.
- We will see in a few classes an alternative way of computing it.

WACC

	Beta	Cost of Equity	Cost of Debt	% Equity	% Debt	WACC
Hershey Company	0.37	5.2%	1.5%	89.1%	10.9%	4.8%
Target	0.54	6.2%	2.5%	75.9%	24.1%	5.1%
Nike	0.51	6.1%	3.2%	98.6%	1.4%	6.0%
Nordstrom	0.9	8.4%	3.4%	70.8%	29.2%	6.6%
Johnson & Johnson	0.79	7.7%	2.1%	94.1%	5.9%	7.4%
Garmin Ltd	0.73	7.4%	N/A	100.0%	0.0%	7.4%
Starbucks	0.77	7.6%	2.0%	97.1%	2.9%	7.4%
Exxon Mobil	0.9	8.4%	2.1%	89.3%	10.7%	7.6%
Apple	0.98	8.9%	2.3%	89.3%	10.7%	8.1%
Microsoft	1.05	9.3%	2.4%	91.0%	9.0%	8.6%
Boeing	1.27	10.6%	2.8%	89.0%	11.0%	9.7%
Weyerhaeuser	1.41	11.5%	3.6%	82.7%	17.3%	9.9%
Amazon.com	1.64	12.8%	2.5%	97.7%	2.3%	12.6%
AMD	2.32	16.9%	10.9%	59.8%	40.2%	13.0%



2016 numbers

Capital Budgeting Process

1. Given the capital structure find the appropriate discount rate of the firm using WACC

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

2. Compute the NPV of the project

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

3. Make investment decision using the appropriate investment decision rule.