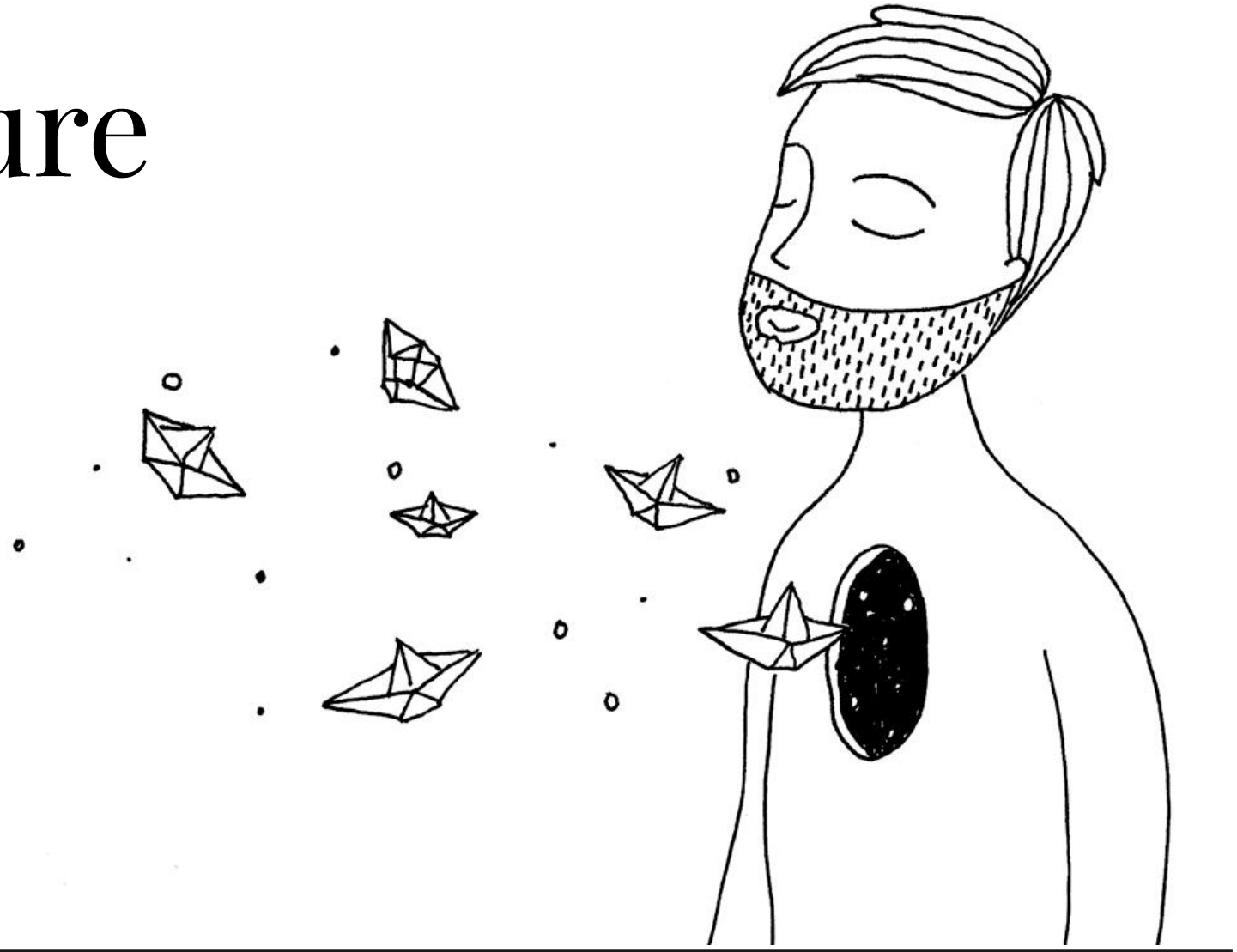
Video Lecture

Capital Structure



Advanced Financial Management

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Overview

- NPV and firm value
- Financial leverage and risk
- Capital structure in a perfect world: Modigliani and Miller propositions
- Capital structure with taxes

NPV and firm value

NPV and the value of the firm

Market Value Balance Sheet

Consider a public all equity company:

Market value Balance Sheet

A = Assets €1,000,000	E = Equity €1,000,000

The firm currently has 100,000 shares outstanding. Thus

$$P = \frac{€1{,}000{,}000}{100{,}000} = €10$$

What is the impact of a project?

Example

This company engages in a project with the following characteristics:

- Investment in fixed assets: €800,000
- Cash-flow: €120,000 per year forever
- Project-β=1.6, r_f=2%, E(r_M)=7%
- The project is financed by equity.
- Cost of capital from the CAPM:

$$r_i = 2\%+1.6*(7\%-2\%) = 10\%$$

$$NPV = -800 + \frac{120}{0.1} = -800 + 1200 = 400$$

NPV and the value of the firm

What is the effect on the market value balance sheet?

1. When the project is announced, the value of the firm immediately **increases by the amount of the NPV** (in an efficient market).

2. Then the firm **issues shares** (equity) to finance to project and **invests.**

3. The final value of the firm will have increased by the PV(CFs generated by the project).

NPV and the value of the firm

Market Value Balance Sheet

1

On announcement

A = Assets €1,000,000	E = Equity €1,000,000
NPV = €400,000	NPV = €400,000

What is the impact of a project?

Example

- Project is announced: value of the firm increases to V=€1,400,000
- Thus the new share price is

$$P' = \frac{1{,}400{,}000}{100{,}000} = €14$$

NPV and the value of the firm

Market Value Balance Sheet

2

Issue and Invest

A = Assets €1,000,000	E = Equity €1,400,000
NPV = €400,000	
New asset €800,000	E' = new equity €800,000

What is the impact of a project?

Example

- How many shares (n) does the firm issue to finance the project?

$$800{,}000 = n \cdot P' \Leftrightarrow 800{,}000 = n \cdot 14$$

$$n = 57{,}142.86$$

- Then the firm gets new equity:

$$E' = 57{,}142.86 \cdot 14 = 800{,}000$$

NPV and the value of the firm

Market Value Balance Sheet

3

Issue and Invest

Firm's assets are worth the *PV of the expected CFs* they provide.

A = Assets €1,000,000	E = Equity €1,400,000
NPV = €400,000	
New asset €800,000	E' = new equity €800,000

Shareholders own the right to receive the future CFs generated by this business as dividends.

Total Firm Value	**€2,200,000**	**€2,200,000**

What is the impact of a project?

Example

The value of new equity is also the amount spent on the new asset (the investment). This may be a new plant, a new machine, etc.

$$V_{firm} = V^{old} + V^{project}$$

where

$$V^{project} = PV\left(FCF^{project}\right) = NPV + Investment$$

NPV and the value of the firm – using own assets

1

On announcement

A = Assets €1,000,000	E = Equity €1,400,000
NPV = €400,000	

2

Invest

A = Assets €200,000	E = Equity €1,400,000
New asset €800,000	
NPV = €400,000	

3

Invest

A = Assets €200,000	E = Equity €1,400,000
New asset €800,000	
NPV = €400,000	
€1,400,000	**€1,400,000**

Assume the firm's Assets are all cash and it uses it to invest in the project.

$V_{firm} = V^{old} + V^{project}$ still holds.
But V^{old} goes down by 800,000

Financial leverage and risk

What is capital structure?

- Capital Structure refers to the mix of financing instruments (e.g. shares, preferred stock, bonds, warrants, etc.) a firm uses to fund its investments (assets).

- Broadly speaking, we can think of capital structure as being composed of debt and equity.

$$\text{Leverage ratio} = \frac{Debt}{Assets} = \frac{Debt}{Debt+Equity}$$

Market value Balance Sheet

A = Assets	D = Debt
	E = Equity

Debt vs Equity

Equity

- Equity/Stock/Share-holders are owners of firm & have voting rights
- Equity holders receive dividends & can sell shares in stock market
- Shareholders are protected by **limited liability**

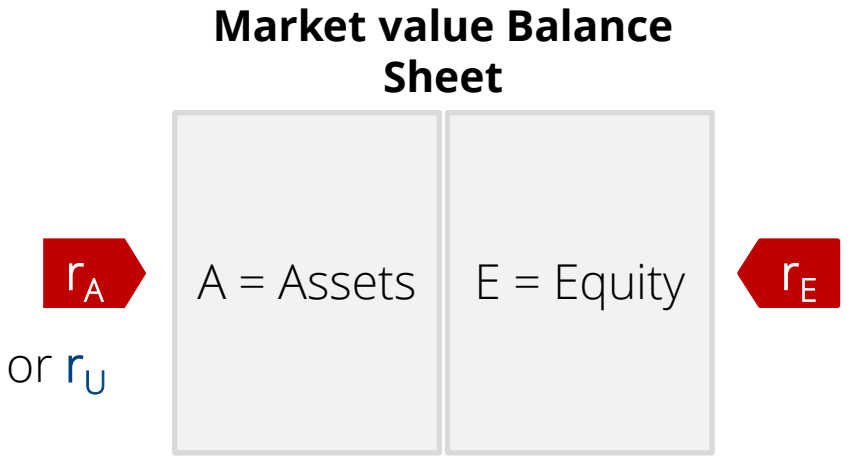
Debt

- Many types: loans, bonds, notes
- Bonds are long-term securitised loans, i.e. can be re-sold
- Creditors/Debt-holders typically receive interest payments (fixed rates or floating rates), and repayment of principal at maturity
- Interest payments are paid out of **pre-tax profits**

Notation

Name	Notation
Market value of equity	E
Market value of debt	D
Market value of assets	A
Rate of return of equity	r_E
Rate of return of debt	r_D
Rate of return of assets	r_A . Can also be denoted as r_U (unlevered return).
Value of the unlevered firm (no debt)	$V_U = A = E$
Value of the levered firm	$V_L = E + D = A$

Value of an unlevered firm



- V_U= A = E, because all CF's to the firm end up in the hands of **equityholders**.
- Also risk is identical: $r_E = r_A$ (the risk of the firm's business)

Financial leverage impact

Questions:

- What happens to the required return demanded by shareholders?
- What is the relation between the risk and the return of shareholders of a levered company?

- We will show the payoff increases in good states, but the risk also increases.
- We expect the cost of equity to increase with debt, because risk also increases.

Return of unlevered firm

Example

Data on firm CS

- Market value of Assets = € 8000
- Financed 100% by equity (no debt, unlevered)
- Number of shares = 400. Stock price:

$$P_{cs} = \frac{8000}{400} = 20$$

- There are no corporate taxes

There are three possible outcomes for the EBIT of the firm:

	Recession	Expected	Expansion
EBIT (€) = EBT	400	1200	2000
EPS (€)	1	3	5
ROE	5%	15%	25%

Return of levered firm

Example

Firm CS

- Wants to issue €4,000 of debt and buy back 200 shares (leaving 200 shares outstanding). Thus, firm has 50% of debt.

$$P_{CS} = \frac{4000}{200} = 20$$

- Debt interest rate = 10%

What is the effect of this decision on EPS?

	Recession	Expected	Expansion
EBIT (€)	400	1200	2000
Interest (€)	4000x10% = = 400	400	400
EBT (€)	0	800	1600
EPS (€)	0	800/200 = 4	8
ROE	0%	20%	40%

Financial leverage impact

- The EPS increased from 3 to 4 in the expected scenario.
- If a recession occurs, EPS are going to be lower, and if there is an expansion the EPS are going to be even higher!
- So, EPS and ROE fluctuate more for the leveraged firm, ie, shareholders of the levered firm will face more risk.
- So far, we did not answer the question of which one is better. A risk averse investor may prefer the firm with less risk, with no debt. A risk neutral, or a less risk averse investor may prefer the other one.

So which one is better?

Capital Structure: no taxes

Modigliani & Miller (MM)

Modigliani and Miller (1958) showed that under the following assumptions ("perfect capital markets"):

1. Investment is held constant
2. No transactions costs
3. Efficient capital markets
4. Managers maximise shareholders' wealth
5. No taxes (or, no differential tax treatment between equity and debt holders)
6. No bankruptcy costs

The value of the firm and the wealth of the shareholders do not change when you change capital structure.

MM Capital Structure Irrelevance

MM demonstrated that:

When there are no taxes and capital markets function well, it makes no difference whether the firm borrows or individual shareholders borrow.

- Shareholders can borrow (and make their returns riskier) **on their own ('homemade leverage')**, so will not pay more to invest in an otherwise identical levered firm.

- The market value of a company does not depend on its capital structure

Example of MM's argument

Example

Firm CS decides to remain unlevered, **but** you preferred the equity payoff from the levered firm (50% debt).

⇒ You can lever up yourself and replicate the levered firm's return:

- Suppose you have €20 to buy 1 share.
- You could borrow €20 (at 10%) and buy two shares (you are replicating the 50% debt, 50% equity structure)

Same as EPS from *unlevered* firm (**no debt**)

	Recession	Expected	Expansion
EBIT (€) = EBT	400	1200	2000
EPS from 1 share (€)	1	3	5
Earnings from 2 shares (€)	2	6	10
Interest (€)	=10%*20=2	2	2
Net earnings	0	4	8

Same as EPS from *levered* firm (**with debt**)

Example of MM's argument

Example

Conclusions:

- This strategy costs €20 of your own money to create and gives you the **exact same payoffs you would receive from the levered firm**.
  - ⇒ So you shouldn't pay any more to invest in a 50% levered CS share.

CS is not creating any value by having debt, in other words, the investor is not receiving anything from corporate leverage that he could not do by himself.

MM Proposition I

$$V_U = V_L$$

- This is the "do your own capital structure" argument
  - Companies do not create value for shareholders by taking leverage since they are achieving the same results shareholders are able to get themselves.

MM Irrelevance holds with risky debt

Risk-free debt:

	All equity firm		Firm with debt (promised payment: 4)	
	Good state	Bad State	Good state	Bad State
Equity	10	4	10 - 4 = 6	4 - 4 = 0
Debt			4	4
Total to all investors	10	4	6 + 4 = 10	4

Risky debt:

	All equity firm		Firm with debt (promised payment: 5)	
	Good state	Bad State	Good state	Bad State
Equity	10	4	10 – 5 = 5	4 – 4 = 0
Debt			5	4
Total to all investors	10	4	5 + 5 = 10	4

Leverage and returns

MM Proposition I states $V_U = V_L$ $\Rightarrow A = V_U = V_L = D + E$.

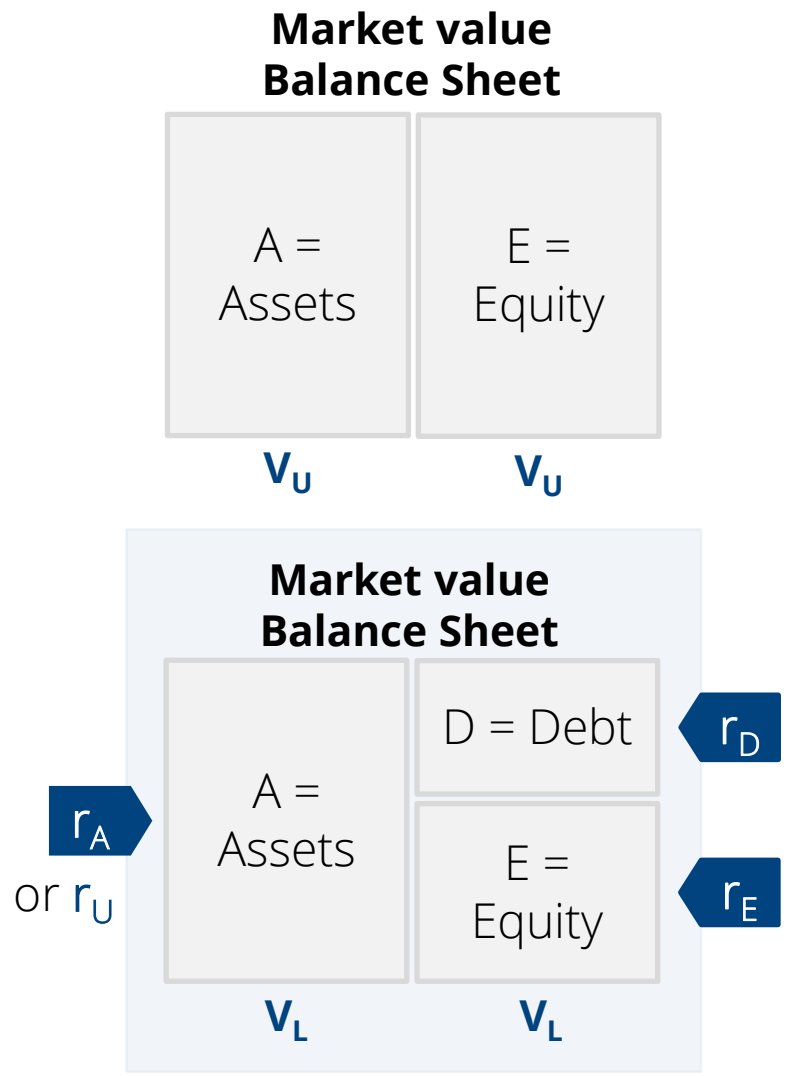
- Therefore, we can think of firm's assets as a *portfolio of the debt and equity* securities used to fund them.
- We know that the expected return on a portfolio is a weighted average of the expected returns of its components, so that:

$$r_A = w_D r_D + w_E r_E$$

Since portfolio weights are the proportion of the total market value of a portfolio that is invested in each security, we have:

$$r_A = \left(\frac{D}{E+D}\right) r_D + \left(\frac{E}{E+D}\right) r_E$$

The weighted average cost of capital (WACC).



MM Proposition II

Re-arranging the WACC expression to make the expected return on levered equity, r_E , the subject of the formula, we get:

MM Proposition II: $$r_E = r_A + \frac{D}{E}(r_A - r_D)$$

MM Proposition II: The expected rate of return on the common stock of a levered firm increases in proportion to the debt-equity ratio (D/E).

Intuition:

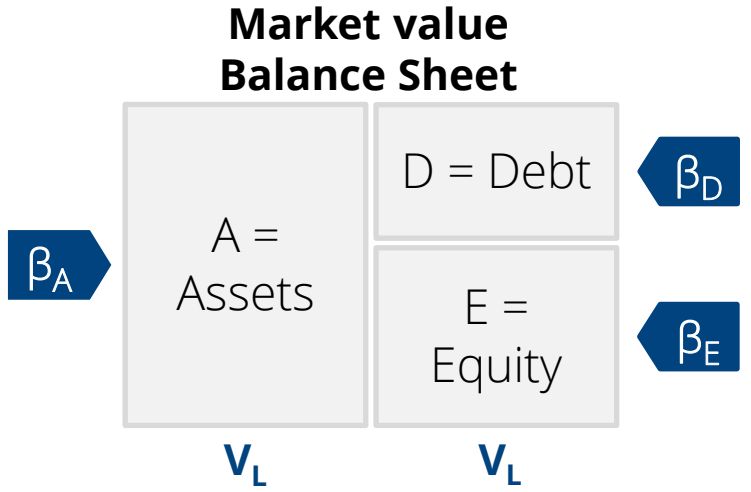
r_E is higher when D/E is higher. This means risk for equityholders is higher when D/E is higher.

- This is why leverage does not affect value.

MM Proposition II and CAPM betas

- If the CAPM is true, then the changes in expected return produced by leverage should correspond to changes in CAPM betas.
- Remember the beta of a portfolio is the weighted average of the betas of the individual securities within the portfolio:

$$\beta_A = w_D\beta_D + w_E\beta_E \Leftrightarrow \beta_A = \left(\frac{D}{E+D}\right)\beta_D + \left(\frac{E}{E+D}\right)\beta_E$$



Re-arranging:

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

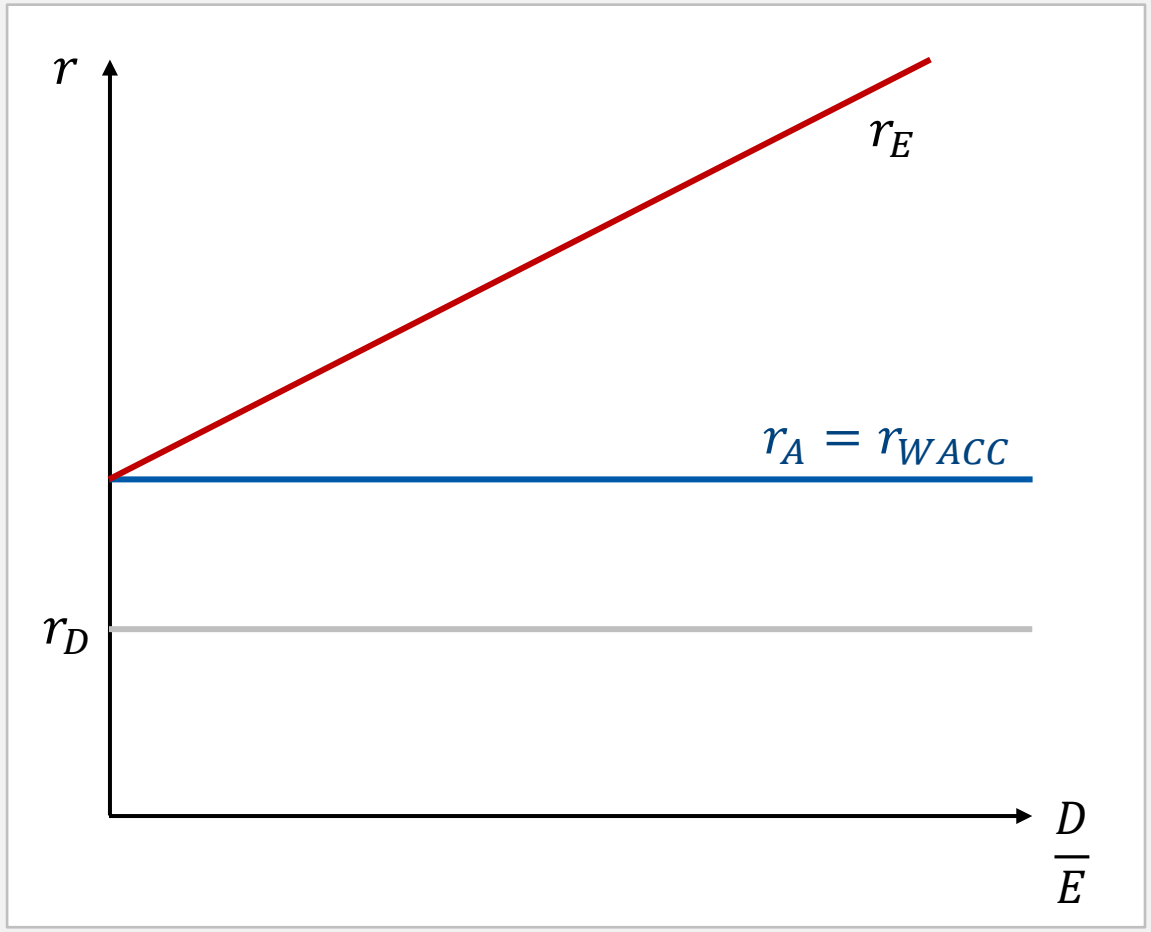
As leverage increases the risk to equity holders increases. Thus, the increase in return on equity is offset by an increase in risk and shareholders' wealth does not change.

MM Proposition II and WACC

- The red line depicts Proposition II: as D/E rises the return on equity will go up (and so will risk).
- The blue line is the return on assets which is equal to WACC:

$$r_A = r_{WACC} = \left(\frac{D}{E+D}\right) r_D + \left(\frac{E}{E+D}\right) r_E$$

- Notice that this is the same for all levels of D/E. This is because leverage does not affect the value of the firm.



Value of the firm

$V_U = V_L$

The value of the firm can be computed from the unlevered CFs:

$V_U = PV(FCF_U)$

- If the firm the firm generates a perpetual CF:

$$V^U = \frac{FCF_1}{r_A}$$

Market value Balance Sheet

A = Assets	D = Debt
	E = Equity
V_L	V_L

The value of debt comes from the present value of the CFs to debtholders:

$D = PV(FCF_D)$

The value of equity comes from the present value of the CFs to equityholders:

$E = PV(FCF_E)$

- $V_U = V_L = E + D$ (MM Proposition I)
- Furthermore, $r_A = r_{WACC}$ and $V^U = V^L = \frac{FCF_1}{r_{WACC}}$ if the firm generates a perpetual CF.

Critiques (among others…)

- The DIY (do-it-yourself)-argument: individuals do not borrow as easily and at the same rate as firms.

- Taxes: If companies are subject to corporate income taxes then they will have a tax advantage over individuals, since the latter may not deduct interest off their taxable income.

- Agency: shareholders of a 99% debt firm will prefer more risky projects relative shareholders of a 50% debt firm.

Capital Structure with taxes

MM Relevance

One or more of these assumptions must be false for Capital Structure choice to add value.

1. Investment is held constant
2. No transactions costs
3. Efficient capital markets
4. Managers maximise shareholders' wealth
5. No taxes (or, no differential tax treatment between equity and debt holders)
6. No bankruptcy costs

Modigliani & Miller with taxes

- What is the impact of taxes on the shareholders cash flows and the value of the firm in unlevered vs levered scenarios?
- Interest payments are tax deductible:
  - By having debt, a firm will be able to reduce tax payments on the cash flows from its projects.
  - This creates value, because the total cash flows that are available for the firm's investors (debt + equity) after taxes are increasing with debt.

- Key to understanding MM with taxes: debtholders and equity holders both have a stake in the firm's cashflows, i.e., both are "owners" of the firm.

MM with taxes

What is the impact on the shareholders cash flows and the value of the firm?

- Let's go back to the example of CS. The expected EBIT is €1200 and it is unlevered
- It considers issuing €2000 debt, at r_D = 10% to buy back shares.
- Assume all Net profits are paid to equity holders as dividends.

	Unlevered	Levered
EBIT (€)	1200	1200
Interest (€)	0	10% x 2000 = 200
EBT (€)	1200	1000
Taxes (40%)	480	400
Net Profits	**720**	**600**
Dividends + Interest	**720**	**800**

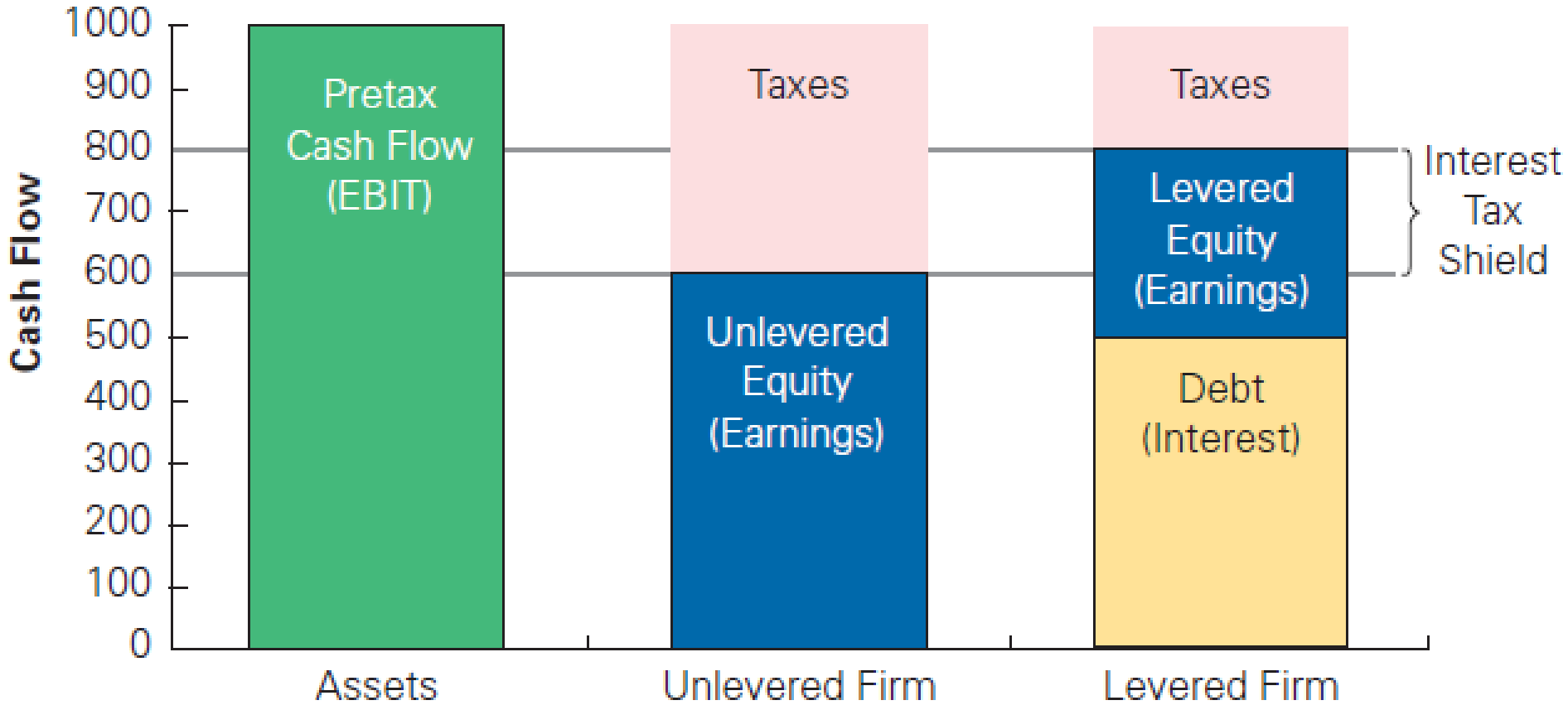
Levered CF > Unlevered CF

MM with taxes

- Income to the firm increases when the firm has debt.
- The increase in income is equal to the **Interest Tax Shield = Interest . t**

	Distribution of EBIT between parties	
Parties	No debt	With debt
Stakeholders of the firm		
(1) Shareholders	EBIT(1 – t)	(EBIT – Interest)(1 – t)
(2) Debtholders	0	Interest
Government	EBIT . t	(EBIT – Interest) . t
Total to the firm (1) + (2)	**EBIT(1 – t)**	**EBIT(1 – t) + Interest . t**

MM with taxes



Valuing the Interest Tax Shield (ITS): MM proposition I

$$\text{ITS} = \text{Interest} \cdot t = (D \cdot r_D) \cdot t = D \cdot r_D \cdot t$$

CF generated with leverage = CF generated without leverage + ITS:

$$FCF_L = FCF_U + ITS \quad \Rightarrow \quad \underbrace{PV(FCF_L)}_{V_L} = \underbrace{PV(FCF_U)}_{V_U} + PV(ITS)$$

Hence, with taxes MM Proposition I:

$$\boldsymbol{V_L = V_U + PV(ITS)}$$

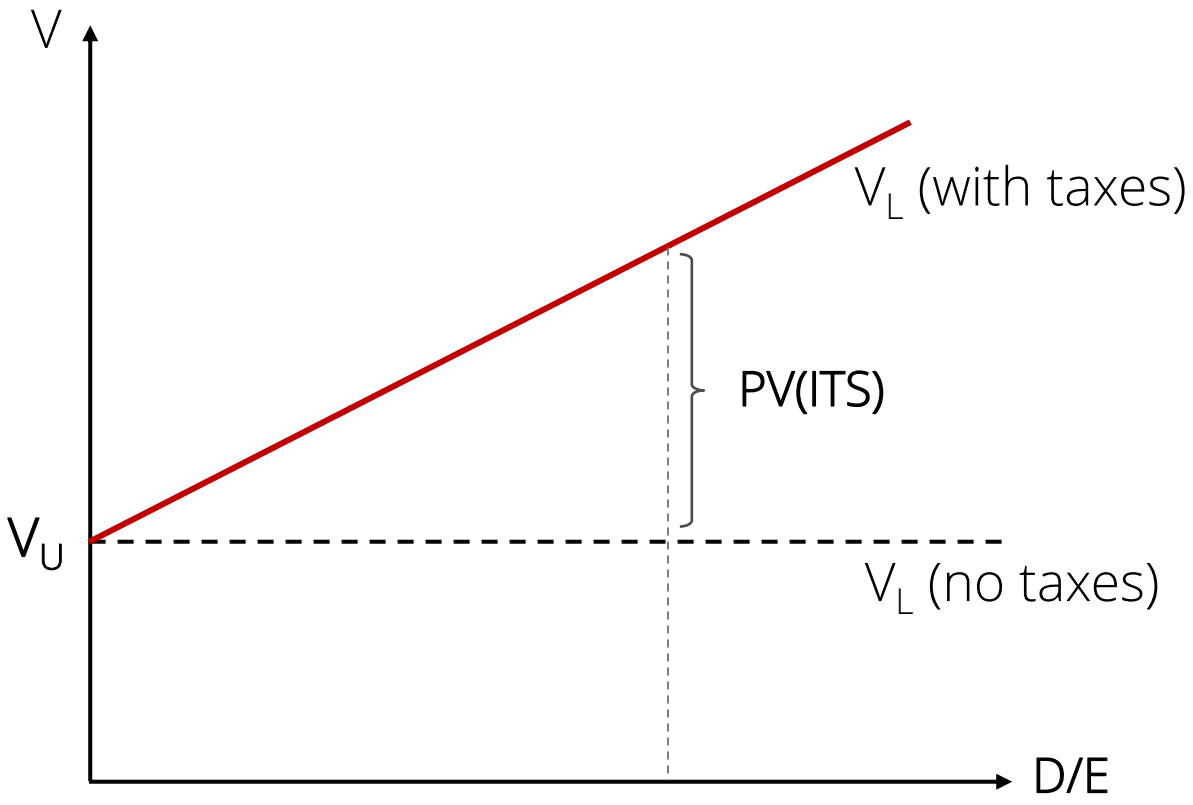
The total value of the levered firm exceeds the value of the unlevered firm due to the present value of the tax savings from debt.

- If the firm has permanent debt: firm plans to keep a fixed dollar amount of debt, D, on its balance sheet permanently, at cost r_D. Then Interest = r_D D for all years, and ITS = r_D D . t . Then:

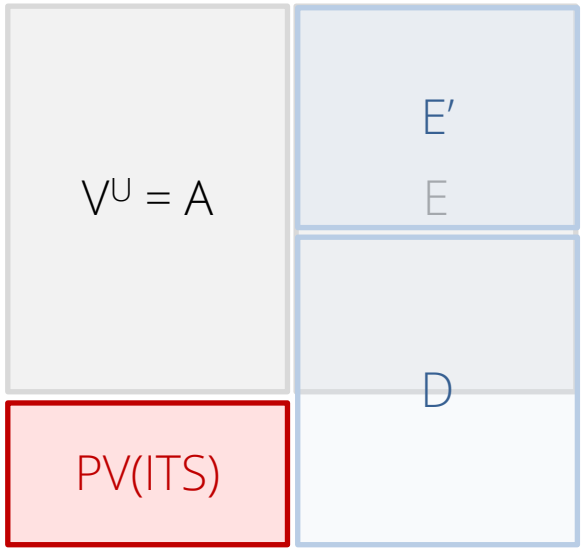
$$V_L = V_U + \frac{D \cdot r_D \cdot t}{r_D} = V_U + t \cdot D$$

Valuing the Interest Tax Shield (ITS)

$$V_L = V_U + PV(ITS)$$



Market value Balance Sheet



Interest Tax Shield (ITS) and WACC

- When the firm borrows money, it is allowed to deduct interest expenses from its income to arrive at taxable income. This reduces its taxes. When the firm uses equity, it is not allowed to deduct payments to equity (such as dividends) to arrive at taxable income.
- What is the effective cost of debt?
  - Cost of debt every period is equal to **Interest** (= r_D . D)
  - The benefit of debt is that it decreases the firm's tax bill by **Interest . t**
  - Thus, the effective cost of debt is **Interest – Interest . t = Interest (1 – t)**

Effective cost of debt:
$D \cdot \underbrace{r_D (1 - t)}$
Effective opportunity cost of debt

Therefore:

$$r_{WACC}^{after-tax} = \frac{D}{E+D} r_D (1-t) + \frac{E}{E+D} r_E$$

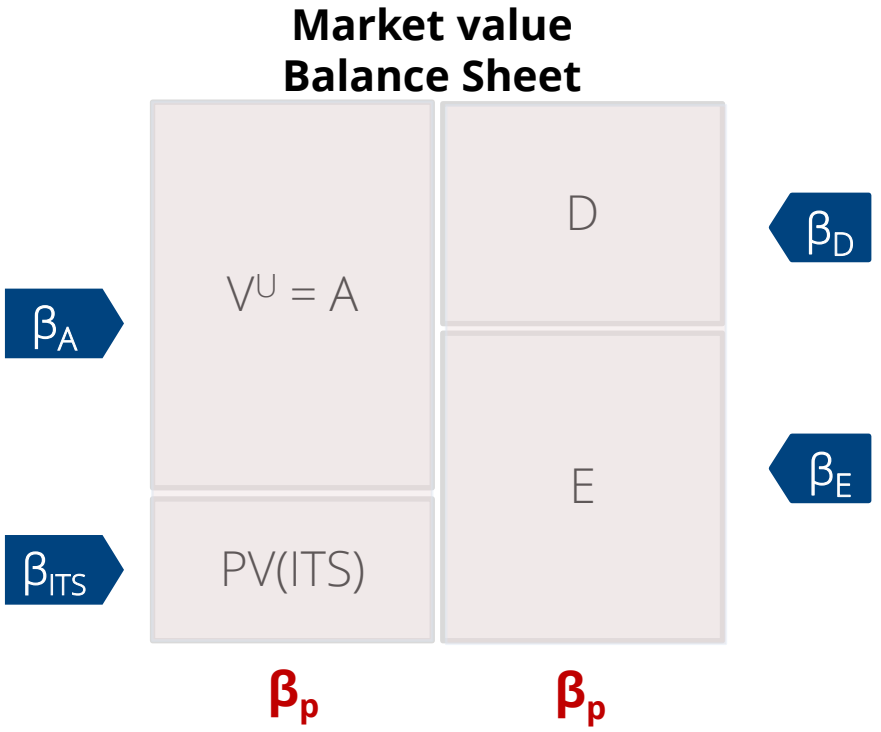
MM proposition II

The effect of ITS on MM proposition II depends of the beta of ITS.

- The beta of the firm is the beta of the portfolio of assets:

$$\underbrace{\beta_A \frac{A}{V_L} + \beta_{ITS} \frac{PV(ITS)}{V_L}}_{\beta_p} = \underbrace{\beta_D \frac{D}{V_L} + \beta_E \frac{E}{V_L}}_{\beta_p}$$

$$\beta_A \frac{A}{D+E} + \beta_{ITS} \frac{PV(ITS)}{D+E} = \beta_D \frac{D}{D+E} + \beta_E \frac{E}{D+E}$$



MM proposition II

Two possible assumptions can be made about ITS beta:

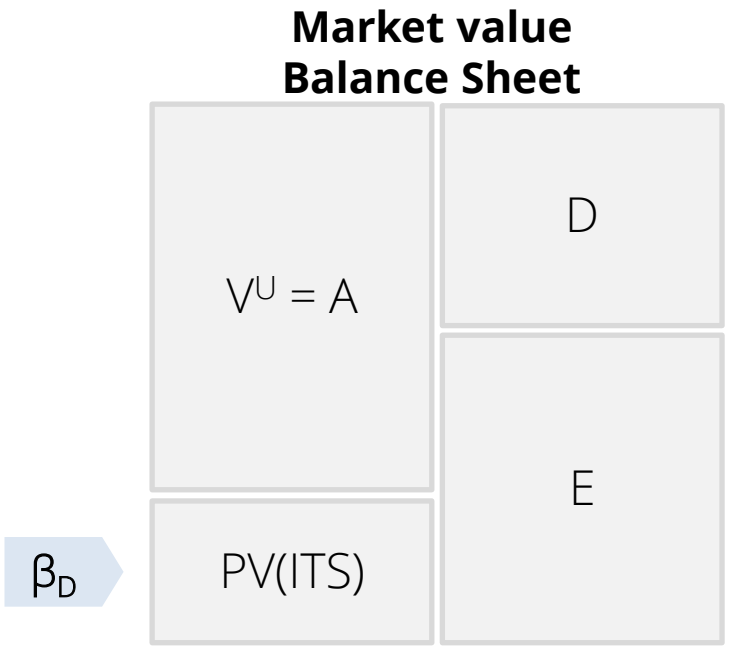
1) Assumption: $\beta_{ITS} = \beta_D$

- This is appropriate when Debt is constant and permanent or low.

$$\beta_E = \beta_A + \frac{D}{E}(1-t)(\beta_A - \beta_D)$$

MM II

$$r_E = r_A + \frac{D}{E}(1-t)(r_A - r_D)$$



MM proposition II

Two possible assumptions can be made about ITS beta:

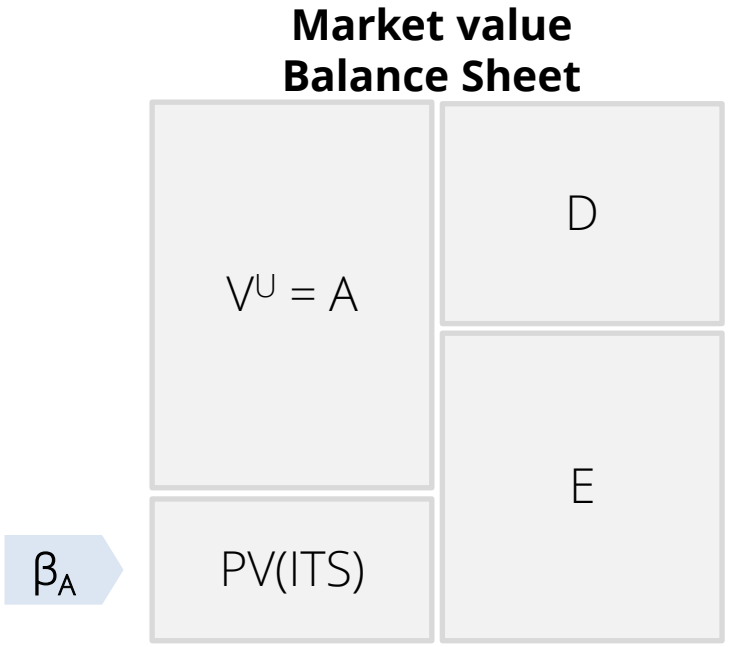
2) Assumption: $\beta_{ITS} = \beta_A$

- This is appropriate when the firm is growing and/or maintains D/E constant

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

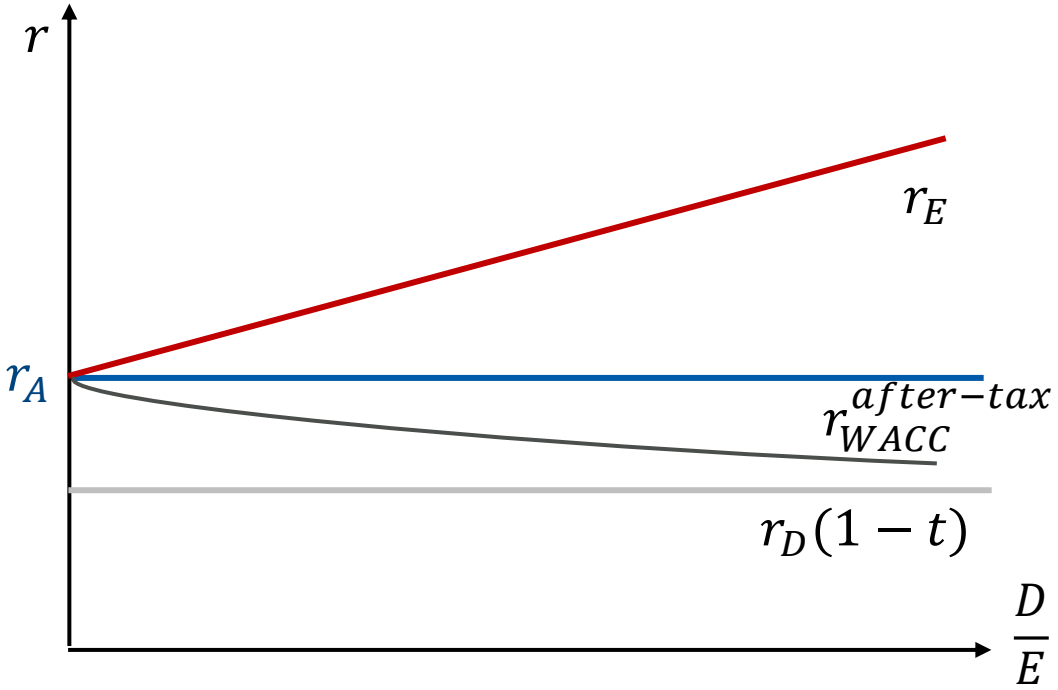
MM II

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



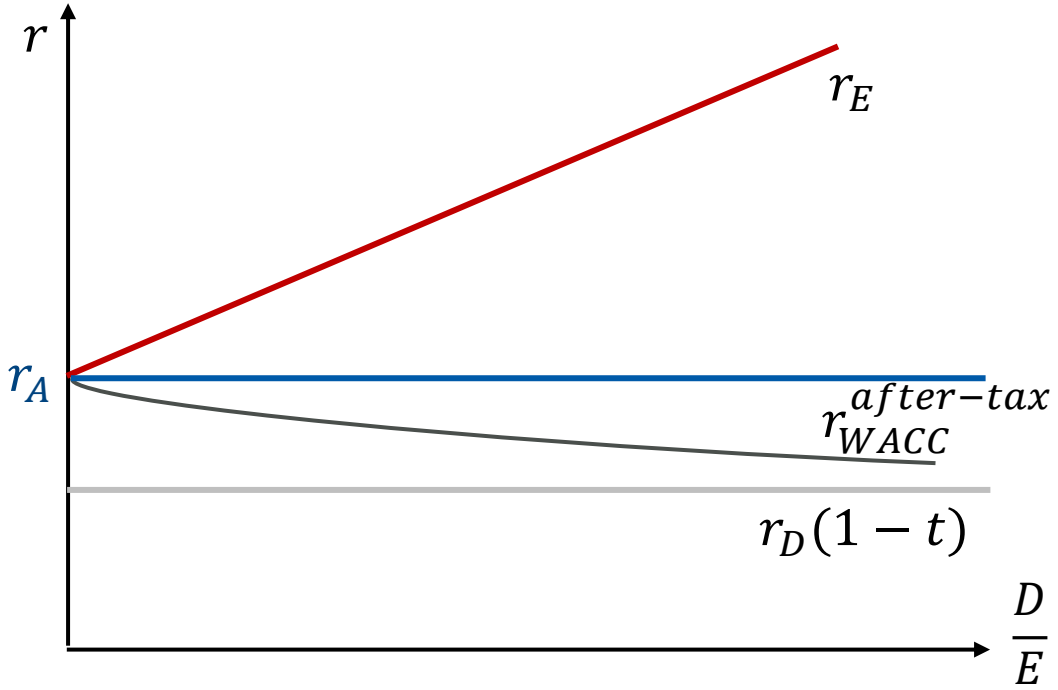
After-tax WACC

Constant debt



- Risk and therefore cost of equity increase with debt, but less strongly than before, because the tax shield makes equity effectively less risky.

Growing firm and D/E constant



- Risk and therefore cost of equity increase with debt as strongly as before, because the tax shield tax shield has same risk as the assets.

Valuing ITS and WACC

- From MM Proposition I: $V_L = V_U + PV(ITS)$
  - This is a general result under the MM assumptions with taxes
  - We compute the value of the firm as if the firm is all-equity financed (as we have done so far)
  - Then we add the PV value of the interest tax shield

- An alternative approach to compute V_L can be used if:
  - Taxes are the only deviation from MM
  - The firm continuously rebalances its leverage to a target ratio, D/(E+D)

$$V_L = \frac{FCF_1}{r_{WACC}^{after-tax}}$$

The value of the ITS is automatically incorporated by discounting using the after tax WACC

NPV and ITS

How do we adjust the NPV of a project to take into account the PV of the financing side effects?

1. We can use the Adjusted Present Value (APV) method (variation of Proposition I):

$$APV = NPV(unlevered) + PV(ITS)$$

   a. Use the unlevered CFs generated by the firm
   b. Use r_A to discount the unlevered cash-flows
   c. Discount the interest tax shield separately. Use the appropriate discount rate (r_D if firm has low or permanent debt, or r_A, if the firm has a constant debt target)

2. Alternatively, we just calculate NPV using WACC to discount the future FCFs
   a. Use the unlevered CFs generated by the firm
   b. Use the after-tax WACC to discount the unlevered cash-flows

   Note: The APV method can be used to incorporate other benefits and costs arising from leverage when we relax more MM assumptions, e.g. bankruptcy costs, agency cost. But more on that later.

Key takeaways

01 **Understand how to incorporate the value of new projects in the value of the firm.**

02 **Understand capital structure irrelevance under the assumptions of Modgliani and Miller model, and impact on returns of shareholders when debt is used to finance the firm's activities (propositions I and II).**

03 **Recognize the impacts on firm value of the capital structures when allowing for corporate taxes.**

04 **Value the firm and projects undertaken by the firm with different capital structures.**