POLITECNICO
MILANO 1863

Accounting Finance & Control

Cost of Capital

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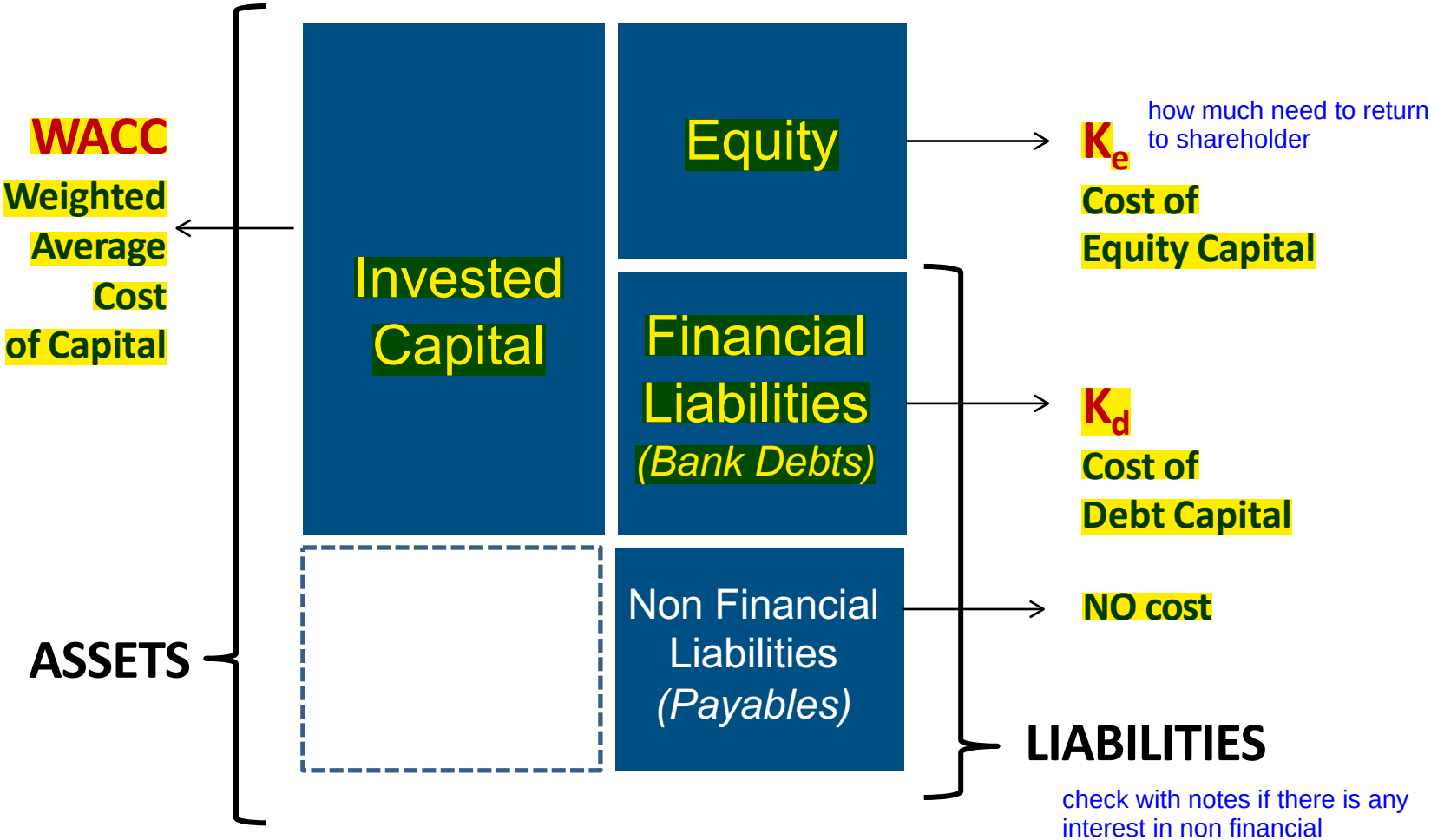
Different Logics on the "cost of capital"



on avg how much we need to return to people to buy this asset
cost of buying assets

cost of capital is due to obligations

WACC : weighted average cost of capital

Weighted Average Cost of Capital - WACC

WACC is the *Weighted Average* Cost of Capital of the firm

Ke >> WACC >> Kd => cost of debt is secured (time, garantee), first to pay,

$$WACC = K_e\left(\frac{E}{D+E}\right) + K_d(1-t_c)\left(\frac{D}{D+E}\right)$$

- K_e: cost of equity
- K_d: cost of debt (pre-tax)
- t_c: corporate tax rate
- $(1 - t_c)$: tax shield if we have interest to pay, we reduce the tax to pay
- E: shareholders' equity
- D: debt (including only *financial* debt)
- E+D = invested capital

توی اینکام استیتمنت بالاتریها
رو داریم زودتر میدیم و کاست
کمتری داره برامون تا اکوییتی

company in good shape must have debts

k_e : cost of equity

Cost of Equity – K_e

K_e is the cost of equity capital for an enterprise

- K_e is how much an enterprise has to remunerate its shareholders for the risk they take by providing equity capital to the enterprise
- K_e is the minimum *expected* return for shareholders
- K_e is not contractually defined
    - How can we estimate it?

Cost of Equity – K_e

how company is perfoming based on two side extreme, risk free and calculated market (how generally industry works)

K_e can be estimated through the

CAPM (Capital Asset Pricing Model) method

$$K_e = r_f + \beta_L (r_m - r_f)$$

- r_f= risk-free rate
- B_L= Beta levered (equity beta)
- r_m= market return
- (r_m - r_f)= market premium

r_f : risk-free rate

Risk free rate – r_f

$\mathbf{r_f}$ is the *theoretical* return on an investment with no risk …

With "no risk" we mean that:

- the investment is done in a condition of perfect information
- there is no uncertainty about what will happen in the future

Under these assumptions…

does a risk-free investment exist?

Risk free rate – r_f

Can we identify a proxy for r_f?

- Government bonds are less risky than corporate bonds
- We select the return on the least risky **government bond** of the **currency area of evaluation**
- In Eurozone the 10Y German Bond is used as a proxy of $\mathbf{r_f}$

german bonds, 10 years

each company, in its zone

Nestle => Swiss, CHF

r_m : market return

Market Return – r_m

$\mathbf{r_m}$ is the return on a *theoretical* market portfolio

which contains *all* the stocks in the market

We can use a proxy…

- **Market indexes** that are **representative of the market where the company operates**

Market Indexes

Index	Country	Description
FTSE MIB	*Italy*	40 largest and most liquid Italian shares traded on Borsa Italiana
DAX	*Germany*	30 largest and most liquid German companies traded on the Frankfurt Exchange
CAC 40	*France*	40 largest and most liquid French companies traded on the Paris Bourse
FTSE 100	*UK*	100 largest and most liquid British companies traded on the London Stock Exchange
EUROSTOXX 50	*Eurozone*	50 largest and most liquid European companies traded on the Eurozone
S&P 500	*US*	500 largest and most liquid US companies traded on NYSE, AMEX or NASDAQ
DOW JONES	*US*	30 largest and most liquid US companies traded on NYSE
NASDAQ composite	*US*	3,000 largest and most liquid US companies traded on NASDAQ (IT companies)

Market Return – r_m (examples)

You want to evaluate the k_e of a company operating only in Italy…

- *Which r_f and market index would you use?*

local company: risk free rate must be on that local (italy government bond rate)

You want to evaluate the k_e of an **Italian** company operating only in Europe (Eurozone)…

- *Which r_f and market index would you use?*

Rf => Germany, italy stocks

You want to evaluate the k_e of an **IT start-up** company operating only in the US…

- *Which r_f and market index would you use?*

Nasdaq & US return

β_L : beta levered *(equity beta)*

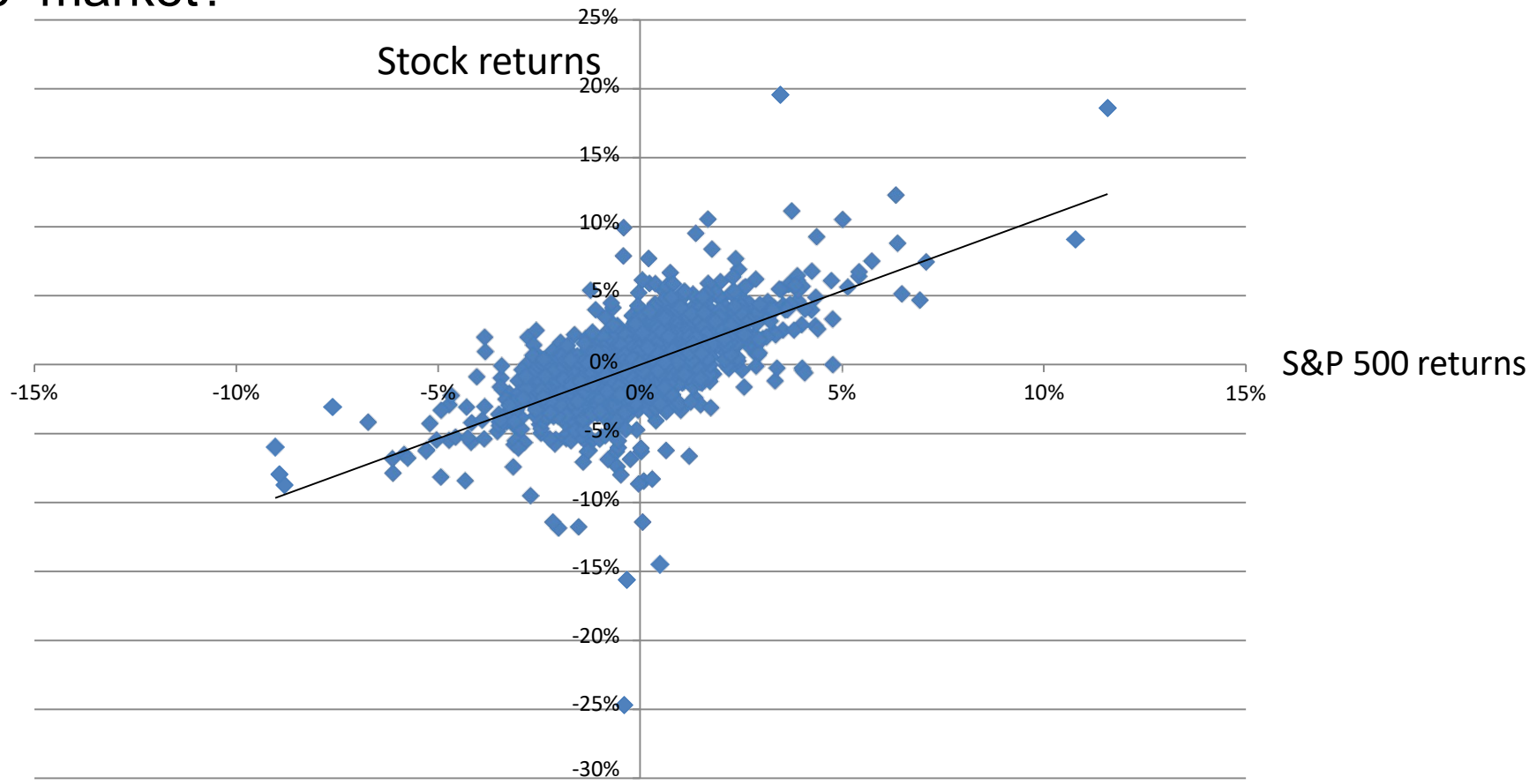
Beta levered - β_L

β_L measures how volatile is the firm stock if compared to the overall market movements

- β_L>1 means that the stock is more volatile than the market (i.e. aggressive) a bit riskier company so expectation of the shareholders are higher, so Ke is higher
- β_L=1 means that the stock is as volatile as the market
- β_L<1 means that the stock is less volatile than the market (i.e. defensive)

Beta levered - β_L

The stock displayed below is aggressive, defensive or in line with the market?



β_L : estimations

Beta Levered - β_L

β_L estimations

1. In case of a listed company:
   - *It can be computed through a regression of the stock returns against the market returns*
2. In case of an unlisted company:
   - *We cannot use the regression since basically the company does not have listed stocks*
   - *We have to infer the **unlevered beta**. We can follow two methods:*
     - ***Comparable companies***
     - ***Beta industry***

β_L and β_U

β_L measures how volatile is a stock if compared to the overall market movements:

- It depends on the **capital structure** of the firm
- Also known as "equity beta"

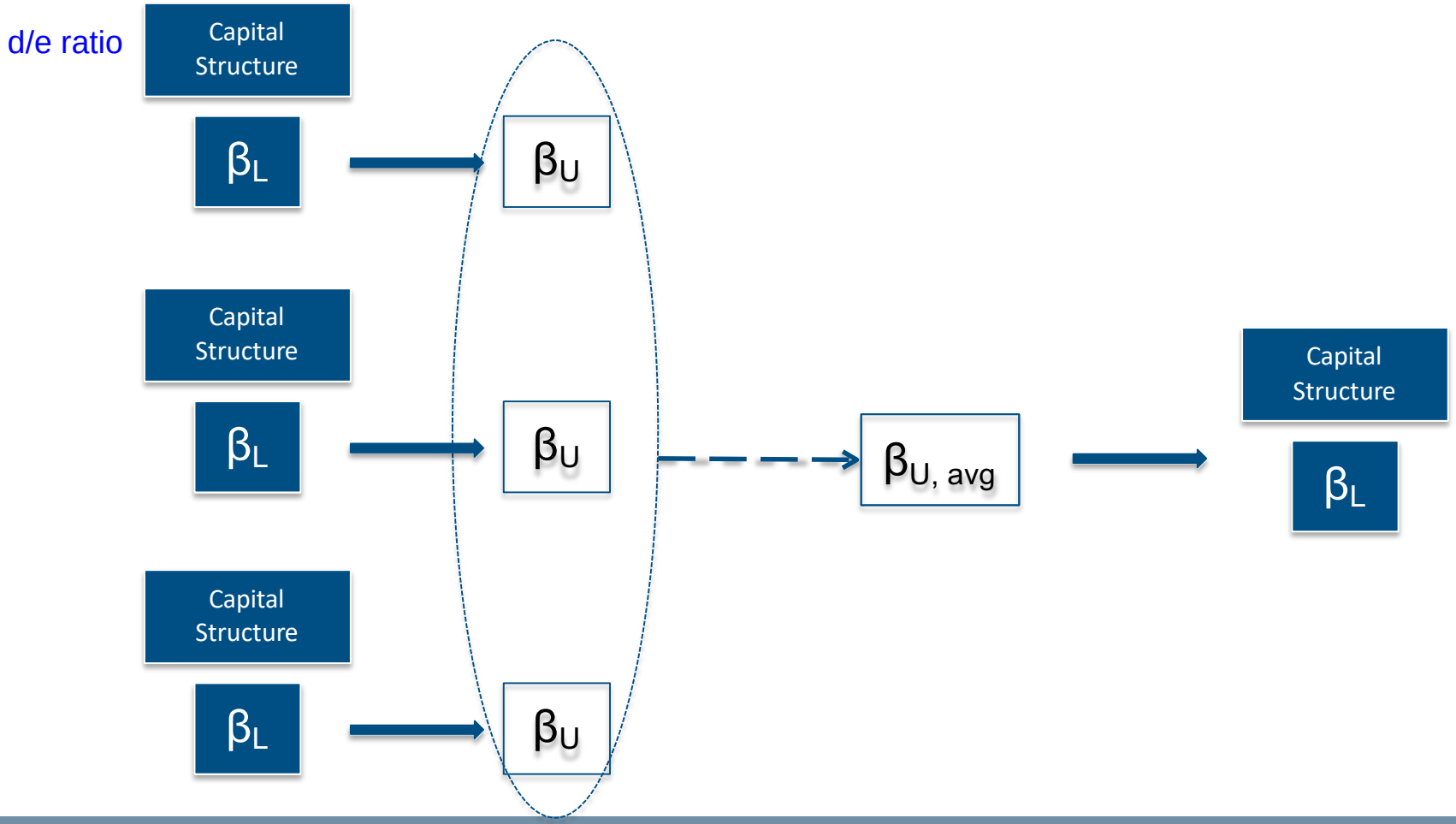
β_U measures how volatile is the underlying business, irrespective of the firm's capital structure:

- It depends on the **industry/business** of a firm but not on the capital structure of the firm!
- Also known as "asset beta"

β_L estimation (comparable companies)

similar to our company (industry, capital structure, how are growing, ...

β_L comparables → β_L target?



β_L estimation (comparable companies)

1. We take comparable companies for which we have β_L
2. We compute the β_U of each comparable company (i.e. by stripping out the capital structure characteristics from β_L)

$$\beta_{U,comp} = \frac{\beta_{L,comp}}{(1 + (1 - t_{c,comp}) * \left(\frac{D_{comp}}{E_{comp}}\right))}$$

tax

3. We compute the average beta $\beta_{U,avg}$ of the comparable companies
4. We re-lever $\beta_{U,avg}$ with the capital structure characteristics of the target company

$$\beta_{L,target} = \beta_{U,avg} * \left(1 + \left(1 - t_{c,target}\right) * \left(\frac{D_{target}}{E_{target}}\right)\right)$$

β_L estimation (beta industry)

As second best as beta unlevered it could be used the one of the industry in which the company operates

Industry	Number of firms	Avg. Levered Beta	Avg. D/E	Avg. Tax rate	Unlevered Beta
Oil-Gas Distribution	12	1,02	53,4%	18,1%	0,71
Restaurant	65	1,16	13,2%	19,2%	1,05
Drug	223	1,08	14,8%	5,1%	0,94
Biotechnology	214	1,23	15,9%	3,0%	1,07
Internet	194	1,17	2,3%	8,4%	1,15
Entertainment	76	1,60	33,9%	12,6%	1,24
Bank	416	0,77	128,2%	16,4%	0,37
Steel	33	1,65	56,2%	24,2%	1,16
Automotive	12	1,73	103,4%	16,2%	0,93
Natural gas utility	27	0,46	66,2%	28,8%	0,31
Water utility	11	0,49	73,2%	31,5%	0,33

$$\beta_{L,target} = \beta_{U,Industry}\left(1+(1-t_{c,target})\left(\frac{D_{target}}{E_{target}}\right)\right)$$

Short case study

Alpha is a US-based company. You want to estimate its equity cost of capital and WACC. The company is not listed, but you have identified some comparable companies.

You have available also the Balance Sheet of Alpha whose main data are **Equity = 650 mln$, Financial Debt = 350 mln$** K_d **(interest = 4%), tax rate 35%**.

As for market indexes, the **FTSE MIB is forecasted at 20% while S&P500 is 14%**.

For risk free rates refer to the next Table.

Short case study

Comparable company	D (mln$)	E (mln$)	β_L	Corporate Tax rate
Comp 1	400	230	1.20	35%
Comp 2	700	400	1.10	32%
Comp 3	600	350	1.15	35%
Comp 4	500	290	1.00	32%

10Y Government Bond Yields	
AMERICAS	
United States	2.06%
Canada	1.91%
Mexico ($)	3.19%
EUROPE	
Germany	0.78%
France	1.16%
Italy	2.45%

Provide an estimation of Alpha's WACC.

Short case study – Solution

Provide an estimation of Alpha's WACC.

$$WACC = K_e\left(\frac{E}{D+E}\right) + K_d(1-t_c)\left(\frac{D}{D+E}\right)$$

$$K_e = r_f + \beta_L\left(r_m - r_f\right)$$

E = 650 mln$

D = 350 mln$

k_d = 4%

t_c = 35%

K_e = ?

Short case study – Solution

Provide an estimation of Alpha's WACC.

$$K_e = r_f + \beta_L (r_m - r_f)$$

10Y Government Bond Yields	
AMERICAS	
United States	2.06%
Canada	1.91%
Mexico ($)	3.19%
EUROPE	
Germany	0.78%
France	1.16%
Italy	2.45%

r_f = 2.06%

r_m = 14%

β_L = ?

Short case study – Solution

Provide an estimation of Alpha's WACC.

Alpha is NOT listed → comparable listed companies through β_U

$$\beta_{L,alpha} = \boldsymbol{\beta_{U,avg}} * \left(1 + (1 - t_{c,alpha}) * \left(\frac{D_{alpha}}{E_{alpha}}\right)\right)$$

Comparable company	D (mln$)	E (mln$)	β_L	Corporate Tax rate
Comp 1	400	230	1.20	35%
Comp 2	700	400	1.10	32%
Comp 3	600	350	1.15	35%
Comp 4	500	290	1.00	32%

Short case study – Solution

Provide an estimation of Alpha's WACC.

Alpha is NOT listed → comparable listed companies through β_U

$$\beta_{U,comp} = \frac{\beta_{L,comp}}{(1 + (1 - t_{c,comp}) * \left(\frac{D_{comp}}{E_{comp}}\right))}$$

Comparable company	D (mln$)	E (mln$)	β_L	t_c	D/E	β_U
Comparable 1	400	230	1.20	35%	**1.74**	**0.56**
Comparable 2	700	400	1.10	32%	**1.75**	**0.50**
Comparable 3	600	350	1.15	35%	**1.71**	**0.54**
Comparable 4	500	290	1.00	32%	**1.72**	**0.46**
					AVERAGE	**0.515**

Short case study – Solution

Provide an estimation of Alpha's WACC.

Alpha is NOT listed → comparable listed companies through β_U

$$\beta_{L,alpha} = \beta_{U,avg} * \left(1 + (1 - t_{c,alpha}) * \left(\frac{D_{alpha}}{E_{alpha}}\right)\right)$$

E = 650 mln$

D = 350 mln$

t_c = 35%

β_u = 0.515

} **β_L = 0.7**

Short case study – Solution

Provide an estimation of Alpha's WACC.

$$K_e = r_f + \beta_L (r_m - r_f)$$

r_f = 2.06%

r_m = 14%

β_L = 0.7

} **k_e = 10.4%**

Short case study – Solution

Provide an estimation of Alpha's WACC.

$$WACC = K_e\left(\frac{E}{D+E}\right) + K_d(1-t_c)\left(\frac{D}{D+E}\right)$$

E = 650 mln$

D = 350 mln$

k_d = 4%

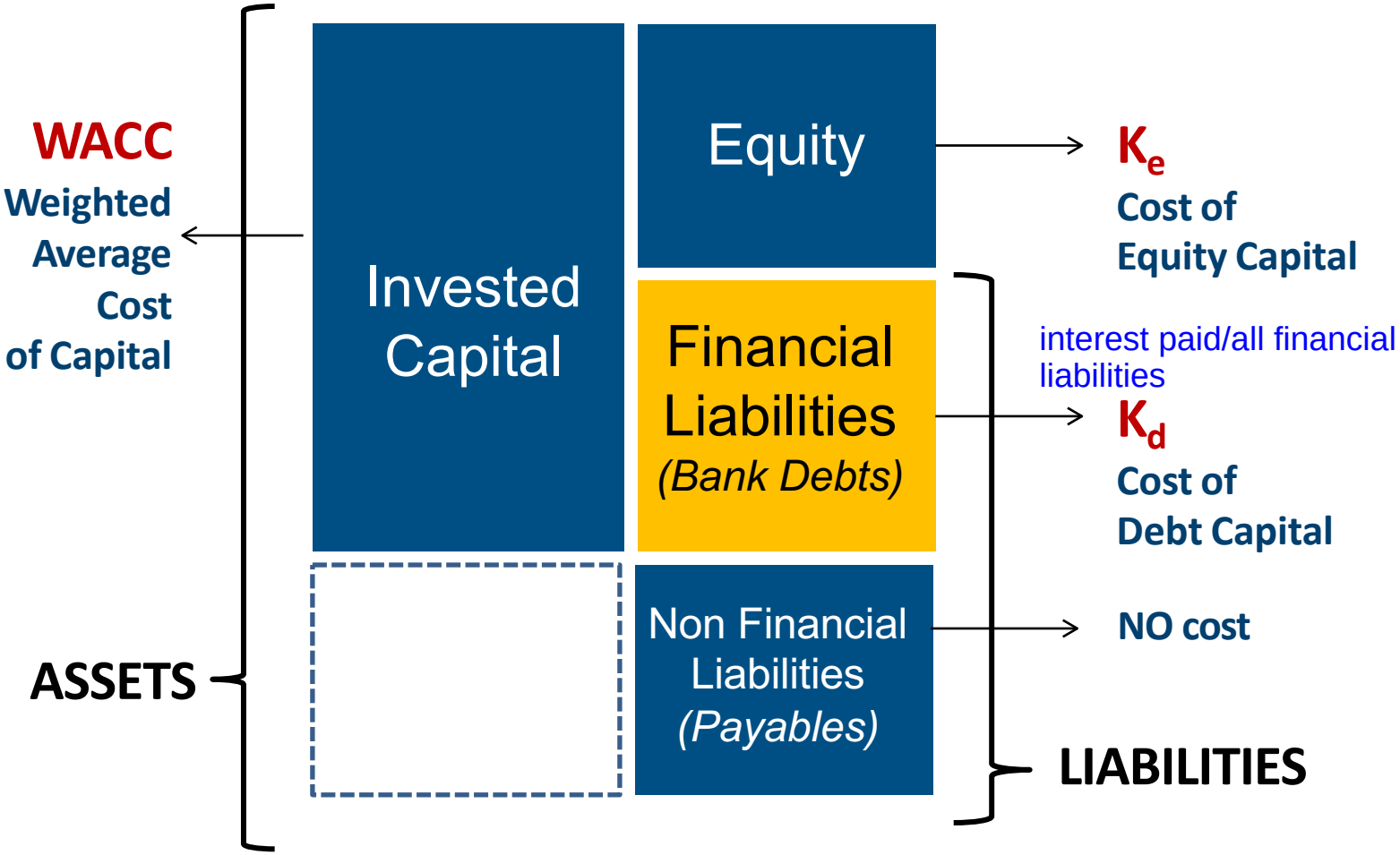
t_c = 35%

k_e = 10.4%

WACC = 7.67%

k_d : cost of debt

Different Logics on the "cost of capital"



Cost of debt – K_d

K_d is the cost of debt for an enterprise

- K_d is the interest that the enterprise has to pay on financial debts to remunerate the debtholders for the risk they take by providing debt capital to the enterprise

- K_d is the return for debtholders

- K_d is contractually defined

Cost of debt – K_d

K_d can be computed as:

$$K_d = r_f + CDS$$

- r_f: risk-free rate
- CDS: **Credit Default Spread**

CDS is associated with the enterprise credit rating

credit rate of a country instead

Cost of debt – K_d (some examples)

Two companies are identical (same business, same size etc.) but they have a different capital structure.

While company A has D/E=5, company B has D/E=1

- *All other things being equal, which company has the riskier profile?* first, more debt

Two companies are identical (same business, same size, same capital structure etc.) but *while company C has a liquidity shortage, company D has stable cash flows*.

- *All other things being equal, which company has the riskier profile?* C, may have problem in repay the debts

Cost of debt – K_d (some examples)

The credit default spread for an enterprise can be estimated using the "financial" characteristics of the firm.

As first step, we can refer just to the *interest coverage ratio*:

Interest Coverage Ratio = EBIT / Interest Expenses

e.g., for different companies, we obtain the following (early 2009):

Company	Operating income	Interest Expense	Interest coverage ratio
Disney	$6,819	$821	8.31
Aracruz	R$ 574	R$ 155	3.70
Tata Chemicals	INR 6,263	INR 1,215	5.15
Bookscape	$3,575	$575	6.22

Cost of debt – K_d (some examples)

Interest Coverage Ratio: Small market cap(<$5 billion)	*Interest Coverage Ratio: Large market cap (>US $ 5 billion)*	*Rating*	*Typical Default*
> 12.5	>8.5	AAA	1.25%
9.50–12.50	6.5-8.5	AA	1.75%
7.50–9.50	5.5-6.5	A+	2.25%
6.00–7.50	4.25- 5.5	A	2.50%
4.50–6.00	3- 4.25	A–	3.00%
4.00-4.50	2.5-3.0	BBB	3.50%
3.50–4.00	2.25-2.5	BB+	4.25%
3.00–3.50	2.0-2.25	BB	5.00%
2.50–3.00	1.75-2.0	B+	6.00%
2.00–2.50	1.5-1.75	B	7.25%
1.50–2.00	1.25-1.5	B–	8.50%
1.25–1.50	0.8-1.25	CCC	10.00%
0.80–1.25	0.65-0.8	CC	12.00%
0.50–0.80	0.2-0.65	C	15.00%
< 0.65	<0.2	D	20.00%

Enterprise	**Market Cap**	**ICR**	**Rating**
Disney	> $ 5 billion	8.31	AA
Aracruz	< $ 5 billion	3.70	BB+
Tata	< $ 5 billion	5.15	A-
Bookscape	< $ 5 billion	6.22	A

Cost of debt – K_d (some examples)

more debt, lower credit rating (consider over time)
take more money, more ebit, doing great.

Enterprise	Market Cap	ICR	Rating
Disney	> $ 5 billion	8.31	AA
Aracruz	< $ 5 billion	3.70	BB+
Tata	< $ 5 billion	5.15	A-
Bookscape	< $ 5 billion	6.22	A

For Tata Chemicals, we will use the synthetic rating of A-,

but we also consider the fact that India faces default risk (and a spread of 3%).

perfomance of the country of HQ

→ $k_d = r_f$ **+ Country Spread** + Company spread

we add it when it's about country volatility

Kd up => first compare it with Rf. (alongside with capital structure/cash flow/credit system) => how good company is doing with debt capital.

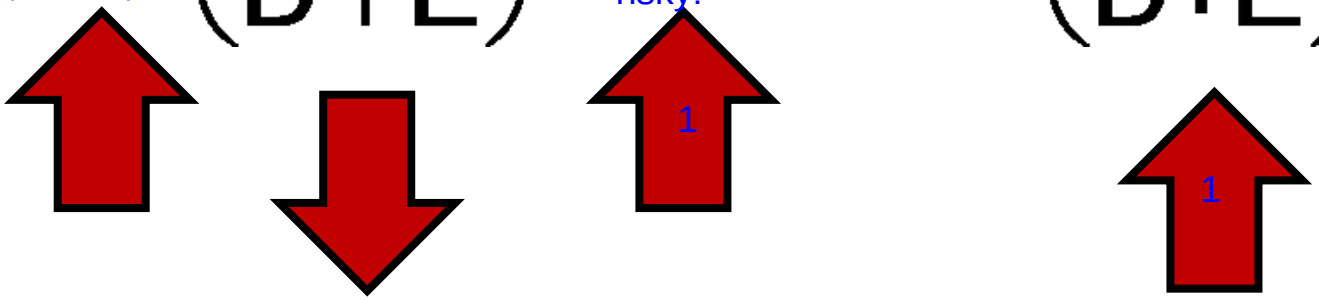
Case study – Company A is leveraging more

leveraging = more debt =>>

$$WACC = K_e\left(\frac{E}{D+E}\right) + K_d(1-t_c)\left(\frac{D}{D+E}\right)$$

debt up => risk up => Ke up

risky!



$k_e > k_d$

$$k_d = r_f + CDS(ICR)$$

increase while debt increase

$$\beta_{L,A} = \beta_{U,avg} * \left(1 + (1 - t_{c,A}) * \left(\frac{D_A}{E_A}\right)\right)$$

10th => 2:30:00 about luiviton strategy!
they issue bonds! great reputation and keep same the Kd