COST OF CAPITAL

2018

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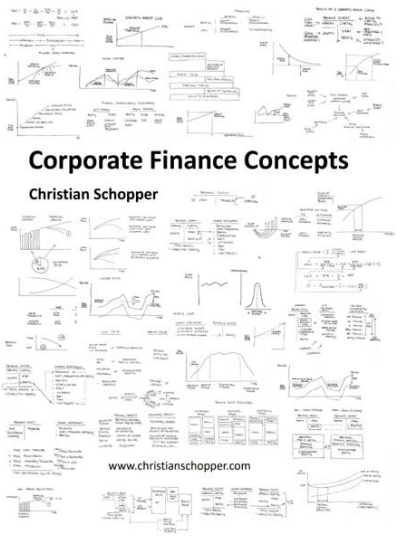
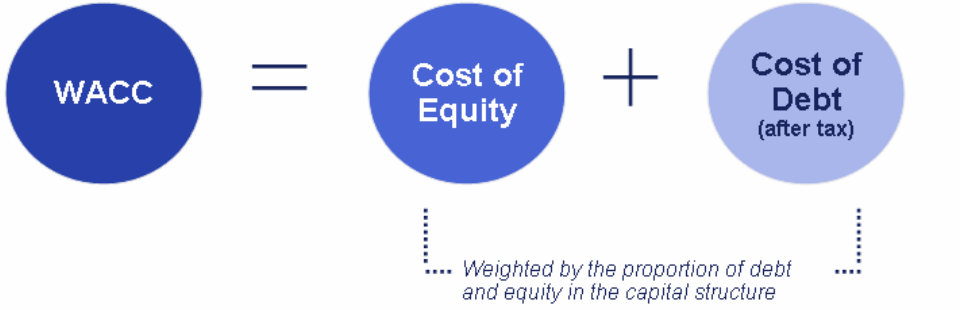


Introduction

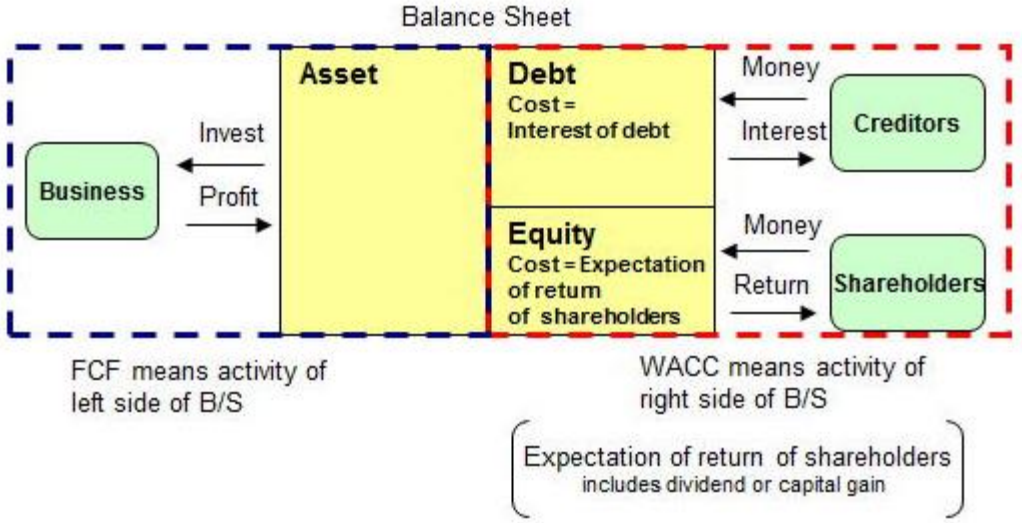
- **Cost of Capital** (CoC) are the **cost of funds used for financing a business**
  - CoC depends on the mode of financing used
  - In most cases a combination of debt and equity is used to finance businesses
  - CoC represents a hurdle rate that must be overcome before generating value

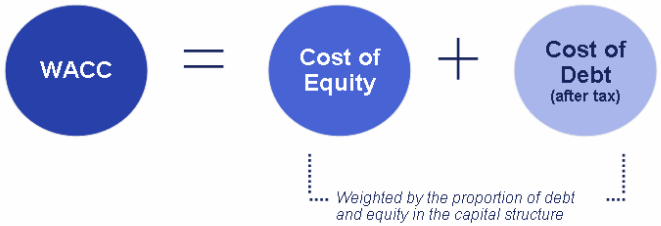
- The **Weighted Average Cost of Capital** (WACC) is a theoretical concept **applied in company valuations** via the Discounted Cash Flow (DCF) valuation
  - WACC shall reflect the long-term stable capital structure of a firm …
  - … and is applied as a factor to discount future expected unlevered free cash flows to the firm, eventually giving the Enterprise Value of the firm



$$WACC = (E/(D+E))\ K_E + (D/(D+E))\ K_D\ (1 - t)$$

Company Valuation





$$WACC = (E/(D+E))\,K_E + (D/(D+E))\,K_D\,(1 - t)$$

Cost of Capital – WACC Simulation

Cost of Debt				Cost of Equity		
Percent Financed with Debt	Credit Default Spread	Before-tax Cost Debt		Input Parameters		
0%	0,50	3,00%		Risk-free rate		2,50%
10%	0,60	3,10%		Market risk premium		7,00%
20%	0,70	3,20%		Unlevered beta		1,0
30%	0,80	3,30%				
40%	1,50	4,00%		CoE (unlevered)		9,50%
50%	3,00	5,50%				
60%	4,50	7,00%				
70%	8,00	10,50%				
Tax rate		35,00%				
Debt/Value Ratio	Equity/Value Ratio	Debt/Equity Ratio	Post-Tax Cost of Debt	Levered Beta	Cost of Equity	WACC
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10%	90%	0,11	2,02%	1,07	10,01%	**9,21%**
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Optimal Cost of Capital Structure

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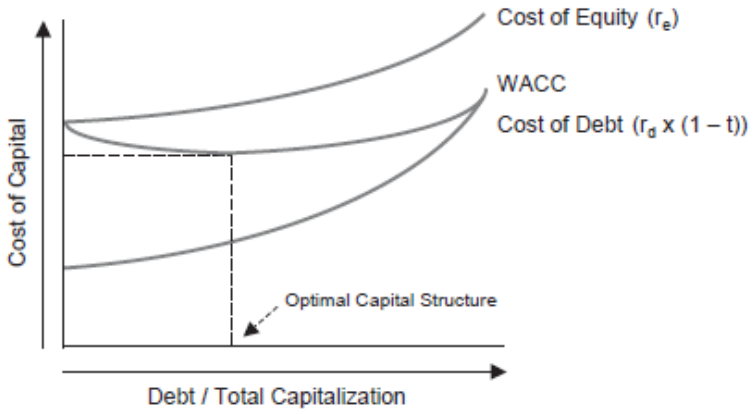

Cost of Equity

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Capital Asset Pricing Model (CAPM)

$$K_e = R_F + (R_m - R_F) \times \beta$$

$$\text{Cost of Equity} = \text{Risk Free Rate} + (\text{Market Risk Premium}) \times \text{Beta}$$

- Alternative: Multi-Factor Model

Cost of Equity - Beta

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- In the CAPM, the risk that a security contributes to a diversified portfolio is measured by its Beta and the expected excess return of the security (MRP) is proportional to Beta

- As higher leverage leads to higher volatility (vis-a-vis the market benchmark), Beta will have to be adjusted through unlevering and re-levering it

$$\beta U = \frac{\beta L}{1 + (1 - t) \times D/E}$$

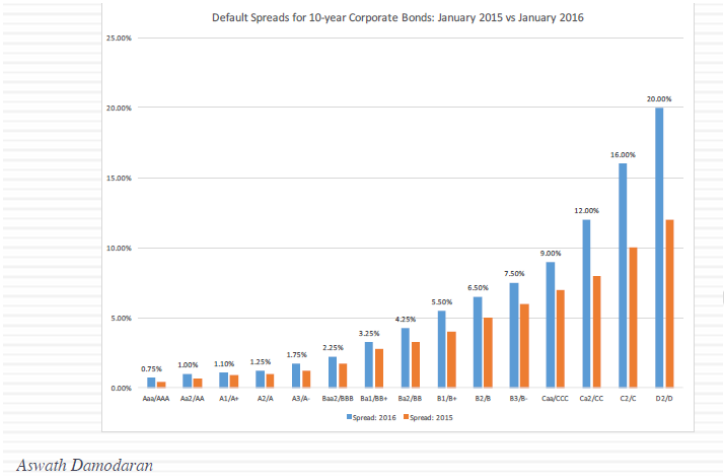
Cost of Equity – Relevering Beta

Changing a Firm´s Capital Structure				
Debt	Equity	Tax	Levered Beta	Unlevered Beta
30,0%	70,0%	35,0%	1,40	1,09
20,0%	80,0%	35,0%	1,27	
50,0%	50,0%	35,0%	1,81	
70,0%	30,0%	35,0%	2,76	

$$\beta U = \frac{\beta L}{1 + (1 - t) \text{ x } D/E}$$

Cost of Debt

- Yield-to-maturity approach
- Debt-rating approach



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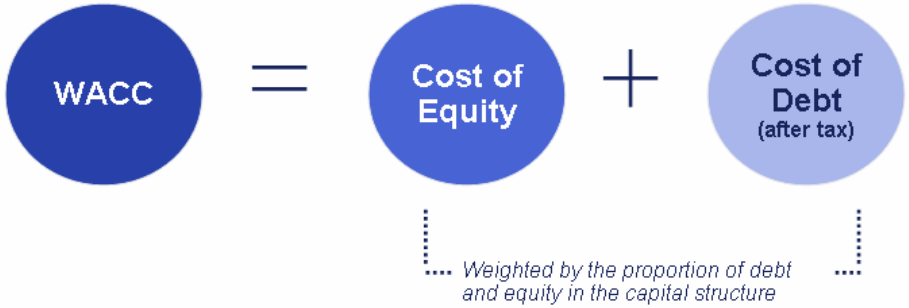
- Interest on debt is tax deductible; therefore, the cost of debt must be adjusted to reflect this deductibility

Weighting of WACC Components

- The weighting of Cost of Equity and Cost of Debt in the WACC is to reflect the company's **long-term, stable target capital structure**

- Cost of Equity and Cost of Debt are **weighted according to** their respective **market values** (and not book values)



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Optimal Mix of Capital

Appendix – The Capital Asset Pricing Model

CAPM – How to Measure Risk

- Financial theory tells us that, on average, higher returns are earned by financial assets that have higher risk. One model used for measuring risk is the Capital Asset Pricing Model (CAPM)

- In the CAPM, the risk that a security contributes to a diversified portfolio is measured by its beta (or), and the *expected excess return* of the security is proportional to beta
  - "Excess Return" refers to the additional return that the security earns above the risk-free rate
  - The excess return earned by the market portfolio is also known as the "market risk premium"
  - The risk premium for an individual security may be higher or lower than the market risk premium depending on the security's beta

- If the beta is greater than one (the beta of the market portfolio is one by definition), then the expected return for the security is higher than the market average, and, if the beta is less than one, the expected return is lower

CAPM – How to Measure Risk (cont´d)

- In the CAPM, the total expected return of a security is given by this equation:

$$E(R_i) = R_f + \beta_i (E(R_m) - R_f)$$

$E(R_i) = expected\,return\,of\,asset$
$R_f = the\,risk\,free\,rate\,of\,return\,(typically\,a\,tbill\,rate)$
$\beta_i = asset's\,beta$
$E(R_m) = expected\,return\,of\,the\,market\,portfolio$

- Only the excess return varies with beta, and the risk free rate is added to the security's risk premium to get the total expected return

- The "expected return" is the return that the investors expect to earn on average given the current price of the security
  - The expected return is what should happen on average over the very long term, but in any given period the realized return may be very different than the expected return

- The expected return is related to price
  - If the price rises (falls), and our expectations of the future cash flows from the security are unchanged, then our expected return falls (rises) since we are paying more for the same future future cash flows

CAPM – The Beta

- Beta is a statistical measure which captures the relationship between the returns of a security and the returns of the overall market

- Beta is calculated as the covariance between the security's excess returns and the excess returns of the market portfolio divided by the market portfolio variance

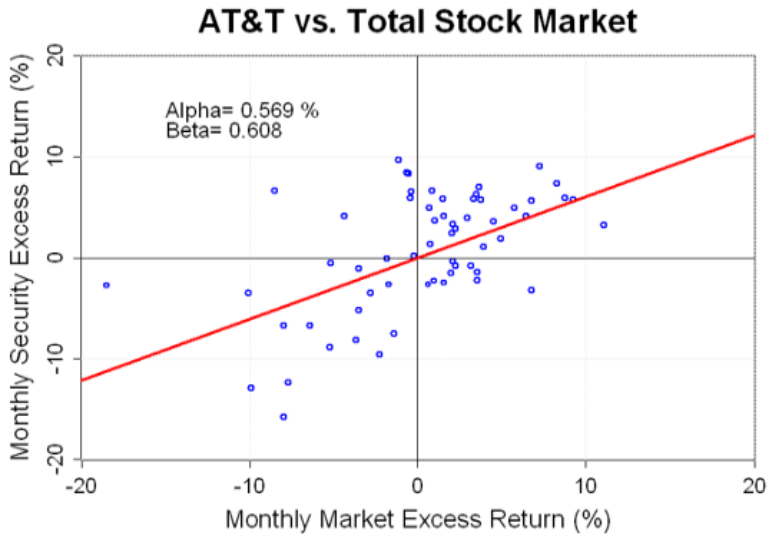
$$\beta_i = \frac{Cov(R_i, R_m)}{Var(R_m)}$$

CAPM – The Beta

- The graph shows 5-years of monthly excess returns on AT&T stock and the monthly excess market returns

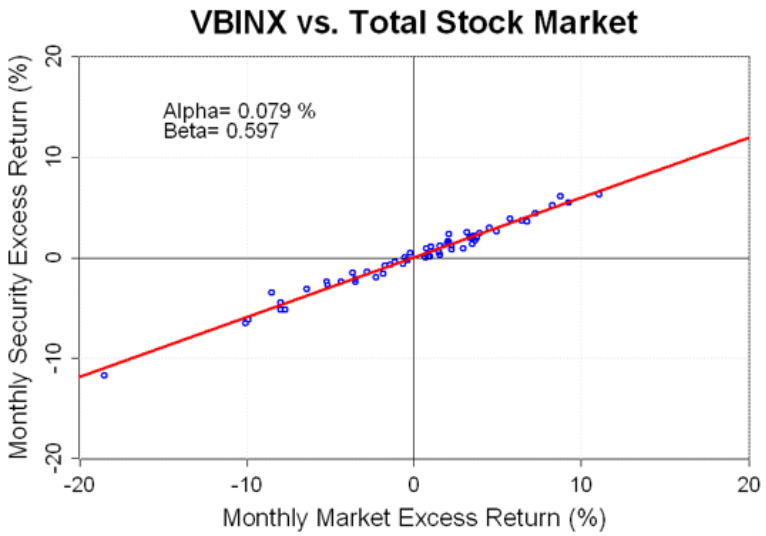
- The red line is the best fit line showing the relationship between the market's excess returns and AT&T's excess returns

- The slope of this line is the beta of AT&T
  - The regression relationship between the AT&T return and the market return is far from perfect, but according to the CAPM these "errors" should average out in a diversified portfolio



CAPM – The Beta (cont´d)

- The graph shows 5-years of monthly excess returns of the Vanguard Balanced Index Fund and the monthly excess market returns
- Whilst this diverse portfolio of both stocks and bonds has a beta very similar to the one of AT&T …
- … scatter plot points in the second graph fall very close to the regression line
- The “diversifiable” risk has been eliminated and we are left only with a “non-diversifiable” exposure to overall market risk



CAPM – Why are average returns expected to be proportional to beta?

- Assume the average return of a stock was *not* proportional to its beta

- If it were possible to find low-beta investment propositions with average returns equal to that of the market, then this would be very desirable portfolio for any risk averse investor
  - Investors would buy these low risk investment propositions (driving up the price of low beta stocks) …
  - … and avoid the high beta stocks which could increase the market risk of the portfolio (driving down the price of high beta stocks)

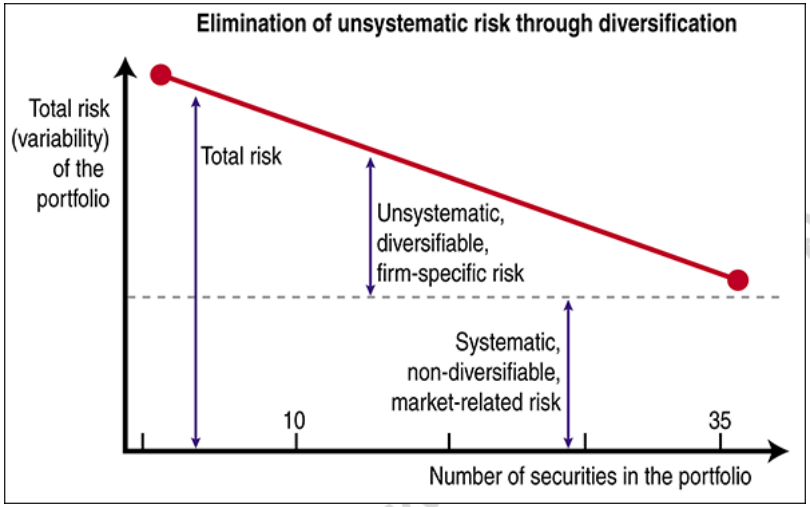
- This arbitrage process would drive down the returns of low beta stocks and drive up the returns of high beta stocks until an equilibrium was reached

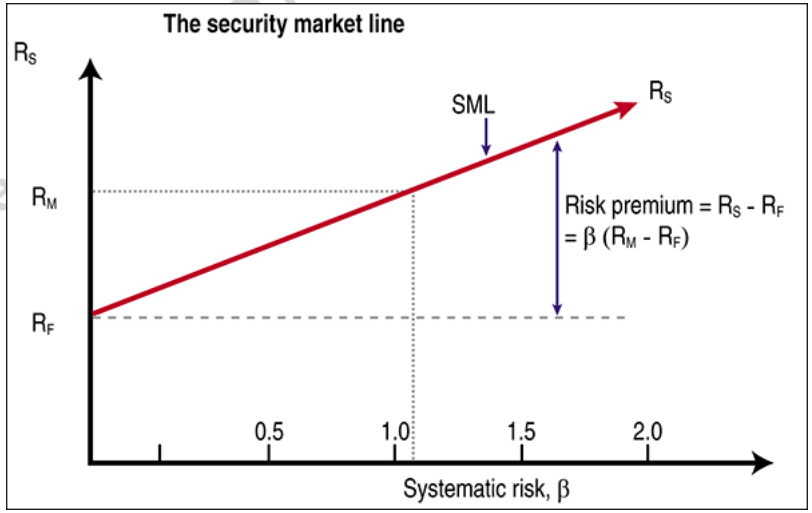
- CAPM suggests that constant trading and instant incorporation of new information keeps markets in exactly this type of an equilibrium: Therefore low-beta stocks should, on average, earn lower returns than high-beta stocks

CAPM – The Alpha

- In the CAPM, alpha is a risk-adjusted measure of return
- It measures the extent to which a security's return exceeds or falls short of the return predicted by the CAPM
- A positive alpha indicates that, after adjusting for exposure to market risk, a security has outperformed the market portfolio.
- Alpha can be measured using the following regression:
- The CAPM suggests that a broadly diversifed portfolio should have an alpha that is close to zero

CAPM – Diversification and Security Market Line





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