

Masters in FINANCE

Business Risk & Financial Risk

Corporate Investment Appraisal

Fall 2017



100 ANOS A PENSAR NO FUTURO





Outline

- Operating Leverage
 - Operating Breakeven point
- Financial Leverage
- Total Leverage
 - Accounting Breakeven point

Note: this material is part of the CFA curriculum, section “Corporate Finance”



Leverage

Leverage refers to the use of fixed costs in a company's cost structure.

Operating leverage has to do with the company's operating cost structure.

Financial leverage has to do with the company's capital structure (i.e., usage of debt).

Why relevant?

Leverage affects risk and return.

Leverage influences a company's business and its future.

Leverage helps us better understand a company's future cash flows, their risk, and valuation.

Leverage: Motivating Example

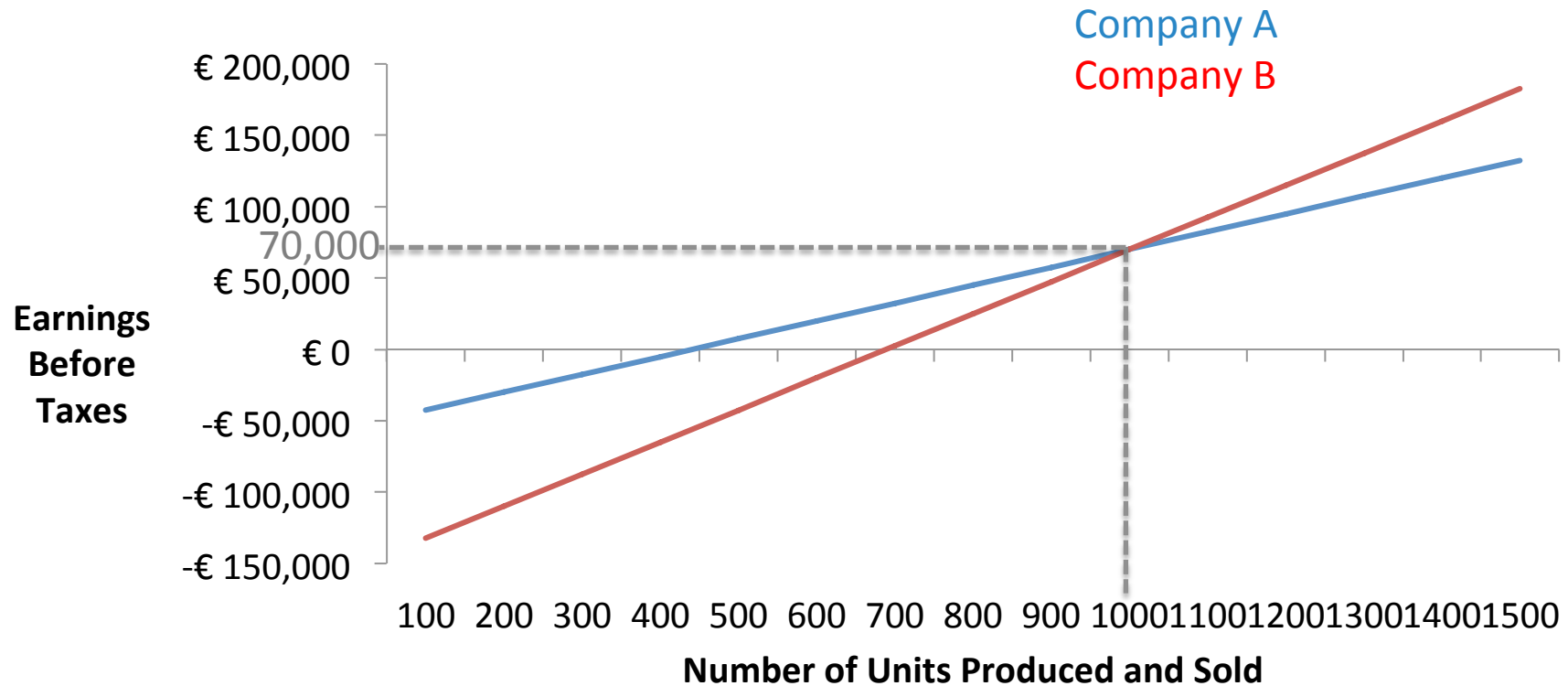


Leverage increases risk to suppliers of capital (creditors and owners).

Consider two companies, Company A and Company B, with the following information:

	Company A	Company B
Number of units produced and sold	1,000	1,000
Sales price per unit	€250	€250
Variable cost per unit	€125	€25
Fixed operating cost	€50,000	€100,000
Fixed financing expense	€5,000	€55,000
Debt	€50,000	€550,000
Equity	€700,000	€200,000
Total assets	€750,000	€750,000

Leverage: What does it mean?



If we compare the variability of the earnings of the companies for different numbers of units sold, we understand that company B is using more leverage – there is more variability (higher slope in the chart above).

Operating Risk and Degree of Operating Leverage (DOL)



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Operating risk is the risk associated with the weight of fixed operating expenses in the cost structure of a company.

The Degree of Operating risk is the sensitivity (i.e., elasticity) of operating earnings to changes in unit sales.

The **degree of operating leverage (DOL)** is the ratio of the percentage change in operating income to the percentage change in units sold.

The **per unit contribution margin** is the difference between the sales price and the variable cost per unit. This difference is available to cover fixed operating costs.

Overall, for all units sold, the **contribution margin** is the difference between total revenues and variable operating costs.

Operating Risk and Degree of Operating Leverage (DOL)



The **DOL** is, *at Q units produced and sold*:

where

Q is the number of units

P is the price per unit

V is the variable operating cost per unit

F is the total fixed operating cost

$$DOL = \frac{Q(P - V)}{Q(P - V) - F}$$

The DOL corresponds to the ratio of the contribution margin to the operating earnings of the company.

For company A, with Q=1000:

$$DOL_A = \frac{Q(P - V)}{Q(P - V) - F} = \frac{1000(250 - 125)}{1000(250 - 125) - 50000} = \frac{125,000}{75,000} = 1.66(7)$$

For company B, with Q=1000:

$$DOL_B = \frac{Q(P - V)}{Q(P - V) - F} = \frac{1000(250 - 25)}{1000(250 - 25) - 100,000} = \frac{225,000}{125,000} = 1.8$$

In our numerical example, Company B faces more operating risk, which is reflected in a higher DOL, due to heavier weight of fixed costs.

Note 1: for a 1% increase in units sold, the operating income of company A would increase by 1.67% and the operating income of company B would increase by 1.8%

Note 2: DOL is not constant! It depends on the Q you start with...

Operating Breakeven Point



The **operating breakeven point** is the level of units at which operating earnings would be zero (i.e., all operating costs would be covered by revenues).

$$\text{Operating Earnings} = Q(P - V) - F$$

$$Q_{obe} = F / (P - V)$$

For company A:

$$Q_{obe_A} = \frac{F}{(P - V)} = \frac{50,000}{(250 - 125)} = \frac{50,000}{125} = 400$$

For company B:

$$Q_{obe_B} = \frac{F}{(P - V)} = \frac{100,000}{(250 - 25)} = \frac{100,000}{225} = 444,44 \text{ or } 445$$

Financial Risk and Degree of Financial Leverage (DFL)



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Financial risk is the risk associated with the weight of debt and interest expenses in the cost structure of a business.

The greater the reliance on fixed-cost obligations, such as debt, the greater the financial risk.

The **degree of financial leverage (DFL)** is the ratio of the percentage change in earnings before taxes to the percentage change in operating income.

The higher the interests expenses of a company (*ceteris paribus*), the higher the degree of financial leverage.

The DFL is the elasticity of earnings available to owners with a change in operating earnings.

Note: The DFL is specific for a given level of operating earnings (and, therefore, Q).

Financial Risk and Degree of Financial Leverage (DFL)



At a specific level of operating earnings (of Q):

where

Q, P, V, F are defined as before

FinCost is the fixed financial cost

$$DFL = \frac{Q(P - V) - F}{Q(P - V) - F - FinCost}$$

The DFL corresponds to the ratio of the operating earnings (EBIT) to the earnings before taxes (or net income) of the company.

For company A, with Q=1000:

$$DFL_A = \frac{Q(P - V) - F}{Q(P - V) - F - FinCost} = \frac{1000(250 - 125) - 50,000}{1000(250 - 125) - 50,000 - 5,000} = \frac{75,000}{70,000} = 1.071$$

For company B, with Q=1000:

$$DFL_B = \frac{Q(P - V) - F}{Q(P - V) - F - FinCost} = \frac{1000(250 - 25) - 100,000}{1000(250 - 25) - 100,000 - 55,000} = \frac{125,000}{70,000} = 1.786$$

In our numerical example, Company B faces more financial risk, which is reflected in a higher DFL, due to heavier fixed financing costs.

Note 1: for a 1% increase in operating earnings, the net income of company A would increase by 1.071% and the net income of company B would increase by 1.786%

Note 2: DFL is not constant! It depends on the Q you start with...

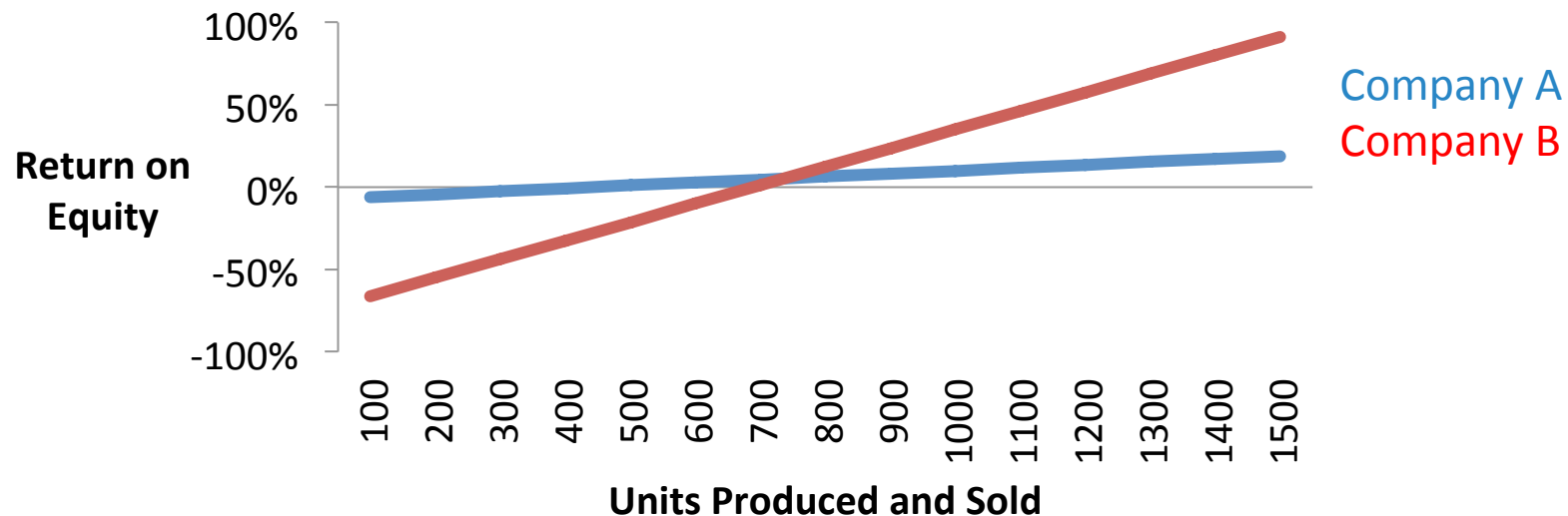
Note 3: If we considered after tax earnings, the factor (1-Tc) would be multiplied both in numerator and denominator.

Degree of Financial Leverage (DFL) influences Return on Equity (ROE)



Companies with a higher DFL expose their equity-holders (owners) to more potential variability in returns.

Remember that $ROE = \text{Net Income} / \text{Equity}$



Note: we did not have taxes in the previous example. For $Q=1000$,
 $ROE(A) = 70,000 / 700,000 = 0.1$
 $ROE(B) = 70,000 / 200,000 = 0.35$

Degree of Total Leverage (DTL)



- Total leverage is the combined effect of the operating leverage and the financial leverage.
- The degree of total leverage (DTL) is the product of DOL and DFL:

$$DTL = DOL \times DFL = \frac{Q(P - V)}{Q(P - V) - F - FinCost}$$

- It basically measures, at a given Q , the impact of a change in the number of units (sales) in the net income.
- The DTL is the elasticity of earnings to owners to changes in units produced and sold (Q).
Note: The focus is on the fixed cost structure of the company – the fixed operating and financial costs.

Degree of Total Leverage (DTL)



For company A, with $Q=1000$:

$$DTL_A = \frac{Q(P - V)}{Q(P - V) - F - FinCost} = \frac{1000(250 - 125)}{1000(250 - 125) - 50,000 - 5,000} = \frac{125,000}{70,000} = 1.7857$$

$$DTL_A = DOL_A \times DFL_A = 1.67 \times 1.071 = 1.7857$$

For company B, with $Q=1000$:

$$DTL_B = \frac{Q(P - V)}{Q(P - V) - F - FinCost} = \frac{1000(250 - 25)}{1000(250 - 25) - 100,000 - 55,000} = \frac{225,000}{70,000} = 3.2143$$

$$DTL_B = DOL_B \times DFL_B = 1.8 \times 1.786 = 3.2143$$

In this example, company B has higher total leverage.

A 1% change in the number of units sold would change the earnings to the owners of Company A by 1.7857%, and would change the earnings to the owners of B by 3.2143%.

Overall accounting Breakeven Point



The accounting **breakeven point** is the level of units at which net income would be zero (i.e., all costs, variable and fixed, are just covered by revenues).

$$Qbe(P - V) - F - FinCosts = 0$$

$$Qbe = \frac{F + FinCosts}{P - V}$$

For company A:

$$Qbe_A = \frac{F + FinCosts}{(P - V)} = \frac{50,000 + 5,000}{(250 - 125)} = \frac{55,000}{125} = 440$$

For company B:

$$Qbe_B = \frac{100,000 + 55,000}{(250 - 25)} = \frac{155,000}{225} = 688.88 = 689$$