

# Masters in FINANCE

## Business Risk & Financial Risk

Corporate Investment Appraisal

Fall 2016



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# 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

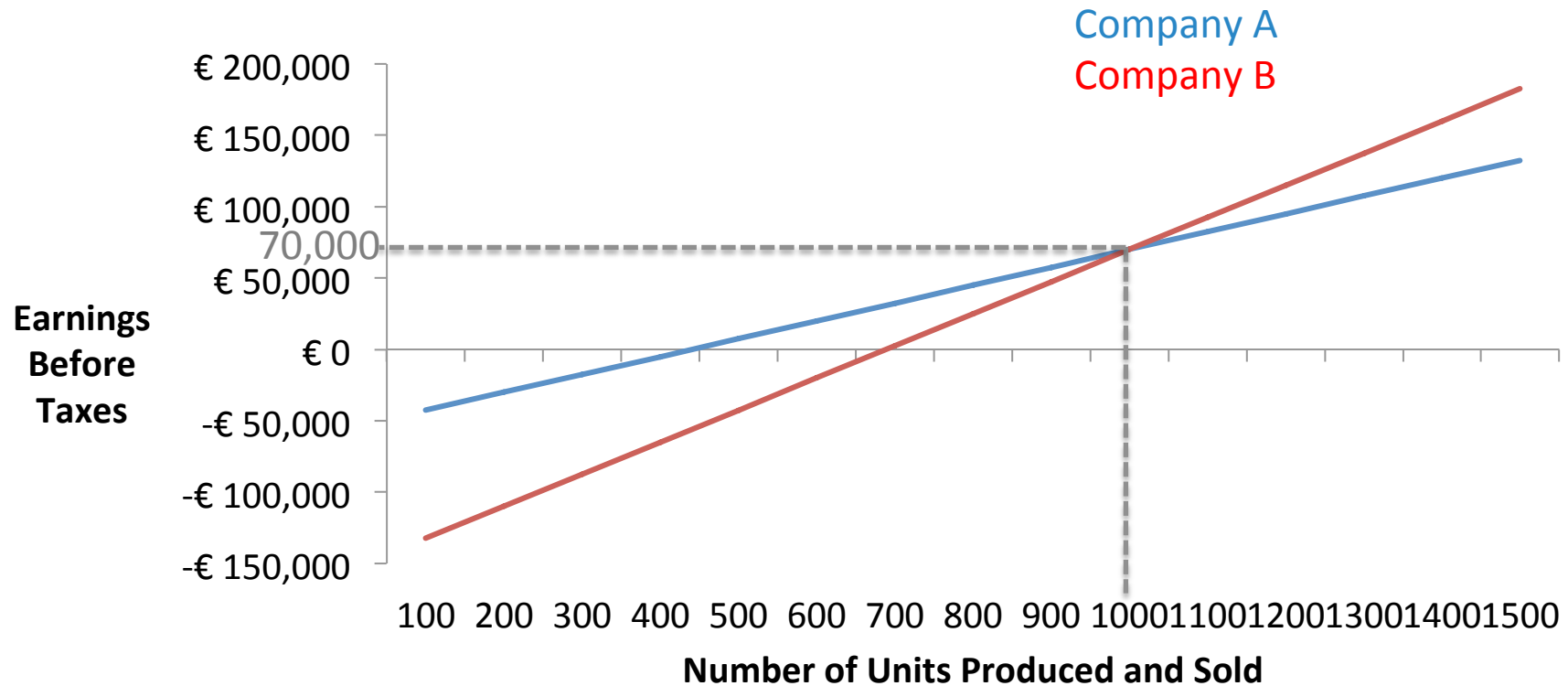


Leverage increases risk to suppliers of capital (creditors and owners).

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...

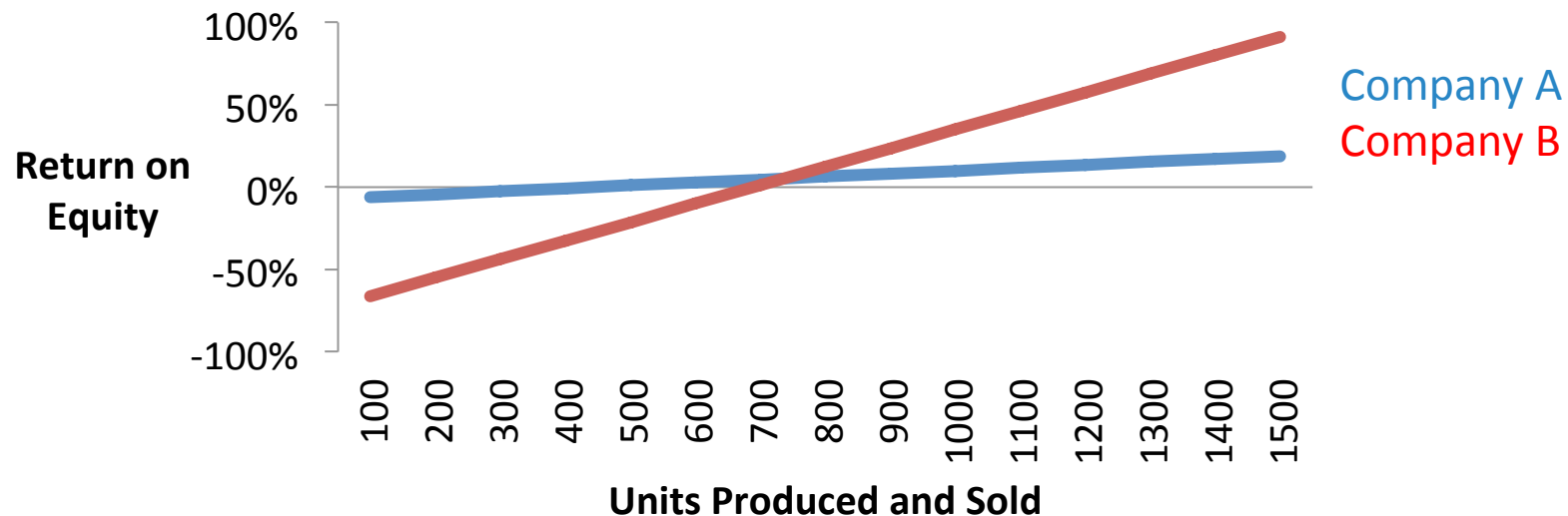
*Note 3:* If we considered after tax earnings, the factor (1-Tc) would be multiplied both in numerator and denominator.

# 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)



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- 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:

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