Project and Enterprise Financing

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Lecture 9: Financial Leverage and Capital Structure

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1. The Effect of Financial Leverage

- **Financial leverage** refers to the **extent** to which a firm **relies on debt**.

  ➔ The more debt a firm uses, the more financial leverage it employs.

Example:

➔ **Trans Euro AG** wants to restructure its capital structure

	Current	**Proposed**
Assets (Mio €)	80	80
Debt (Mio €)	0	40
Equity (Mio €)	80	40
Debt-Equity (D/E) ratio	0	1
Shares outstanding (Mio)	4	2
Share price in €	20	20
Interest rate (p.a.)	10%	10%

- €40 Mio in new debt would be used to purchase 2 Mio (=€40 Mio/€20) shares, leaving 2 Mio shares outstanding.

- 3 Scenarios (assumption for simplicity: Corporate Tax = 0):

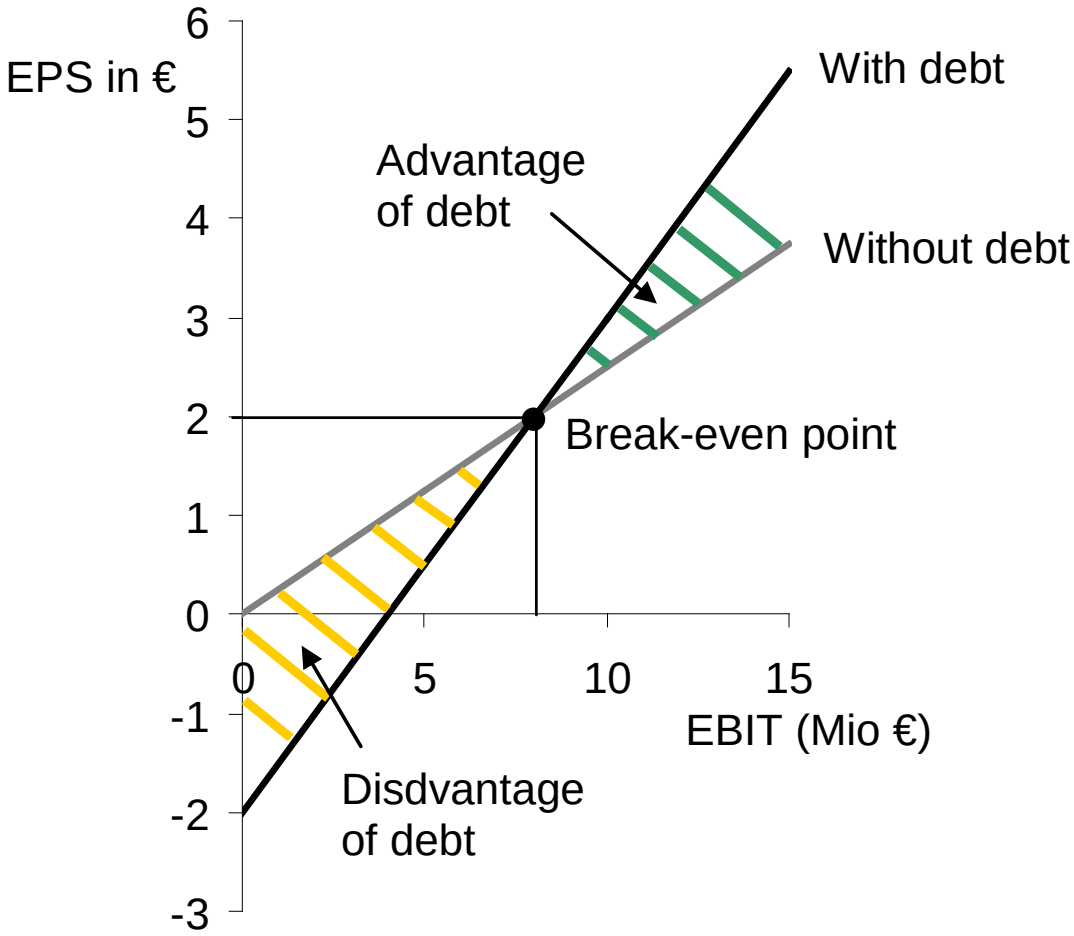
(a) Current capital structure: No debt

	Recession	Expected	Expansion
EBIT (Mio €)	5	10	15
Interest (Mio €)	0	0	0
Net income (Mio €)	5	10	15
ROE	**6.25%**	**12.5%**	**18.75%**
EPS	**€1.25**	**€2.5**	**€3.75**

(b) Proposed capital structure: Debt = €40 Mio

	Recession	Expected	Expansion
EBIT (Mio €)	5	10	15
Interest (Mio €)	-4	-4	-4
Net income (Mio €)	1	6	11
ROE	**2.5%**	**15.0%**	**27.5%**
EPS	**€0.5**	**€3.0**	**€5.5**

The following figure illustrates the impact of leverage on **EPS** (earnings per share) and **EBIT** (earning before interest and taxes):



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With debt: For every €4 Mio increase in EBIT, EPS rises by €2.

Without debt: For every €4 Mio increase in EBIT, EPS rises by €1.

Break-even point:

$$\frac{\text{EBIT}}{4\text{ Mio}} = \frac{\text{EBIT} - €4\text{ Mio}}{2\text{ Mio}}$$

$$\text{EBIT} = 2 \cdot (\text{EBIT} - €4\text{ Mio})$$

EBIT = €8 Mio

Above the break-even point: leverage is beneficial

Below the break-even point: leverage is not beneficial

❍ Corporate Borrowing and Homemade Leverage

- Higher financial leverage: Shareholders are exposed to more risk
  ➔ EPS and ROE are much more sensitive to changes in EBIT

- Shareholders can adjust the amount of financial leverage
  ➔ Borrowing and lending on their own (homemade leverage)

Example

Investor buys 1,000 Trans Euro AG shares, worth €20,000.

3 scenarios:

(a) Proposed capital structure (D/E = 1)

	Recession	**Expected**	**Expansion**
EPS	€0.5	€3.0	€5.5
Earnings for 1,000 shares	**€500**	**€3,000**	**€5,500**

(b) Original capital structure (100% equity) plus homemade leverage

	Recession	Expected	Expansion
EPS	€1.25	€2.5	€3.75
Earnings for 2,000 shares	€2,500	€5,000	€7,500
Less interest on €20,000 at 10%	-€2,000	-€2,000	-€2,000
Net earnings	**€500**	**€3,000**	**€5,500**

Homemade leverage:

- Investor buys 1,000 shares with his own money (€20·1,000 = €20,000)
- Investor buys 1,000 shares with the borrowed money (€20·1,000 = €20,000)

➔ Net payoffs are exactly the same as those for the proposed capital structure.

2. M&M Propositions

Trans Euro AG example:

- An **investor** can **create his own capital structure** (and net earnings distribution), regardless of the firm's capital structure.
- Trans Euros' **capital structure** is thus **irrelevant** for the firm value (and stock price).
- Only true in our simple world: **no** corporate **taxes**, **no rating effects** due to more or less debt
- **Proposition I** of Nobel Prize winners, Franco **Modigliani,** 1985, and Merton **Miller**, 1990 (**M&M**):

  Under the **assumption** of **no corporate taxes** and no rating effects due to more or less debt (**no bankruptcy costs**), the capital structure is irrelevant for the firm value

❍ M&M Proposition II: Cost of Capital and the Financial Leverage

- What happens to the cost of capital when the debt-equity ratio is changed.

WACC without taxes: $WACC = \left(\frac{E}{V}\right) \cdot R_E + \left(\frac{D}{V}\right) \cdot R_D = R_A$

where V = E + D, and R_A is the required return on the firm's overall assets.

If we rearrange to solve for the cost of equity, we get:

$$R_A = \left(\frac{E}{V}\right) \cdot R_E + \left(\frac{D}{V}\right) \cdot R_D$$

$$\boxed{R_E = R_A + (R_A - R_D) \cdot \left(\frac{D}{E}\right)}$$

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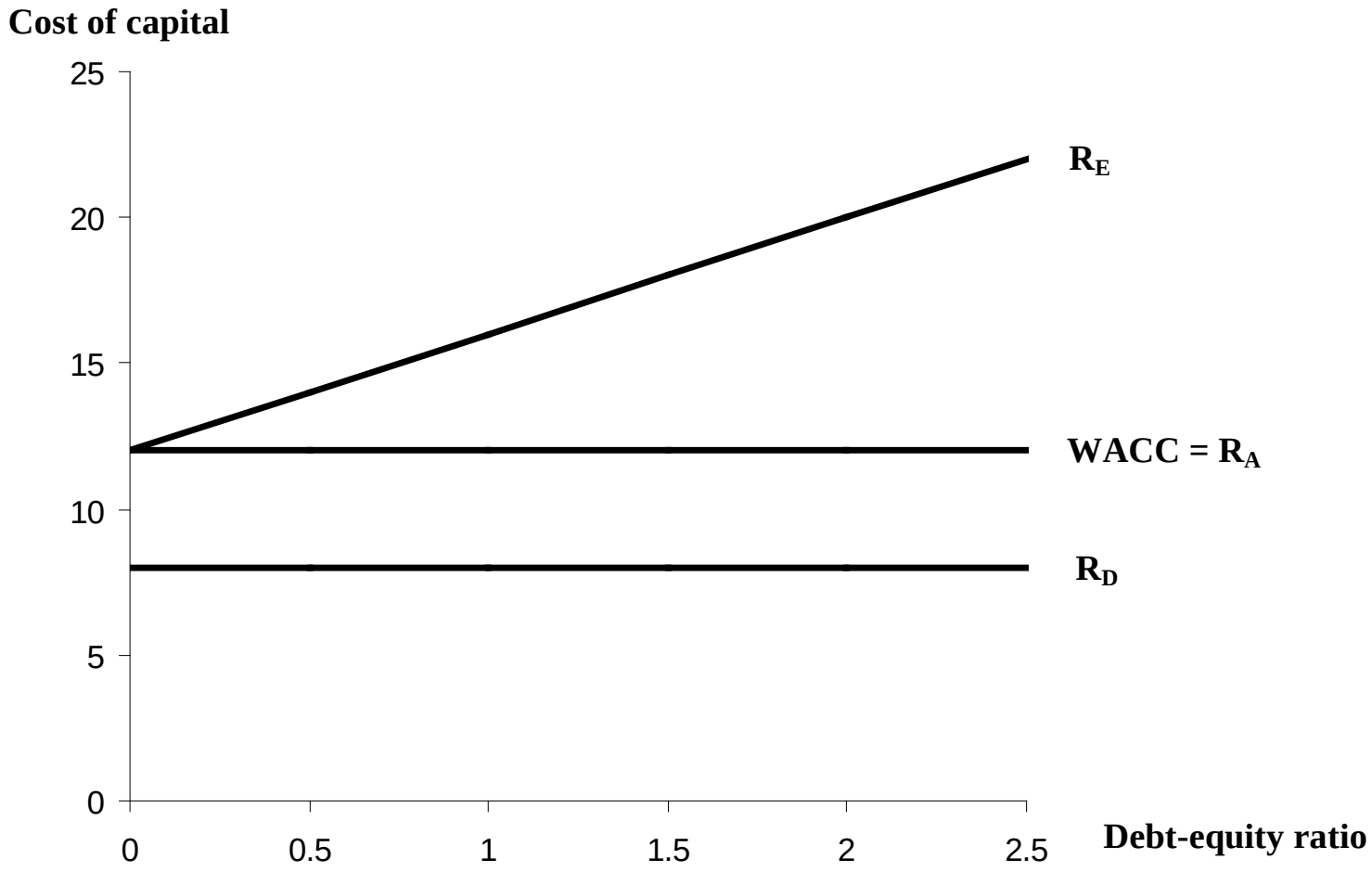
M&M Proposition II:



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3. M&M Propositions with Corporate Taxes

- Real world: corporate taxes
- Interest paid on debt is **tax deductible**; added **benefit of debt financing**
- Two firms: firm U (unlevered) und firm L (levered)
  ➔ Identical on the left-hand side of the balance sheet
- E.g.: EBIT is expected to be €100,000 every year forever for both firms.
- Firm L has issued €100,000 worth of perpetual bonds; 8% interest p.a.
- Corporate tax is 25%.

Net income for both firms:

	Firm U	Firm L
EBIT	€100,000	€100,000
Interest (8%)	0	-€8,000
Taxable income	€100,000	€92,000
Taxes (25%)	-€25,000	-€23,000
Net income	**€75,000**	**€69,000**

➔ Firm L saves €2,000 on tax due to interest expenses.

The cash flow is split between shareholders, bondholders and the state:

Cash Flow to	**Firm U**	**Firm L**
Shareholders	€75,000	€69,000
Bondholders	0	€8,000
Investors total	**€75,000**	**€77,000**
state	€25,000	€23,000
Total	€100,000	€100,000

➔ Interest tax shield = €8,000·0.25 = €2,000 p.a.

- L's cash flow to investors is **always** €2,000 **greater** compared to firm U
  ➔ Firm L is worth more than firm U.

- Value difference: value of the €2,000 perpetuity

- Tax shield is generated by paying interest, it has the same risk as the debt.

- The **value of the tax shield**:

$$PV_T = \frac{€2{,}000}{0.08} = \frac{0.25 \cdot €100{,}000 \cdot 0.08}{0.08} = 0.25 \cdot €100{,}000 = €25{,}000$$

with PV_T = present value of the interest tax shield.

The general formula for PV_T is therefore:

$$PV_T = \frac{T_C \cdot D \cdot R_D}{R_D} = T_C \cdot D$$

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- **M&M Proposition I with corporate taxes** therefore states:

$$V_L = V_U + T_C \cdot D$$

- If cost of capital for firm U (R_U) is 10%: The value of the unlevered firm, V_U, is therefore:

$$V_U = \frac{EBIT \cdot (1 - T_C)}{R_U} = \frac{€100{,}000 \cdot (1 - 0.25)}{0.1} = €750{,}000$$

The value of the levered firm, V_L, is:

$$V_L = V_U + T_C \cdot D = €750{,}000 + 0.25 \cdot €100{,}000 = €775{,}000$$

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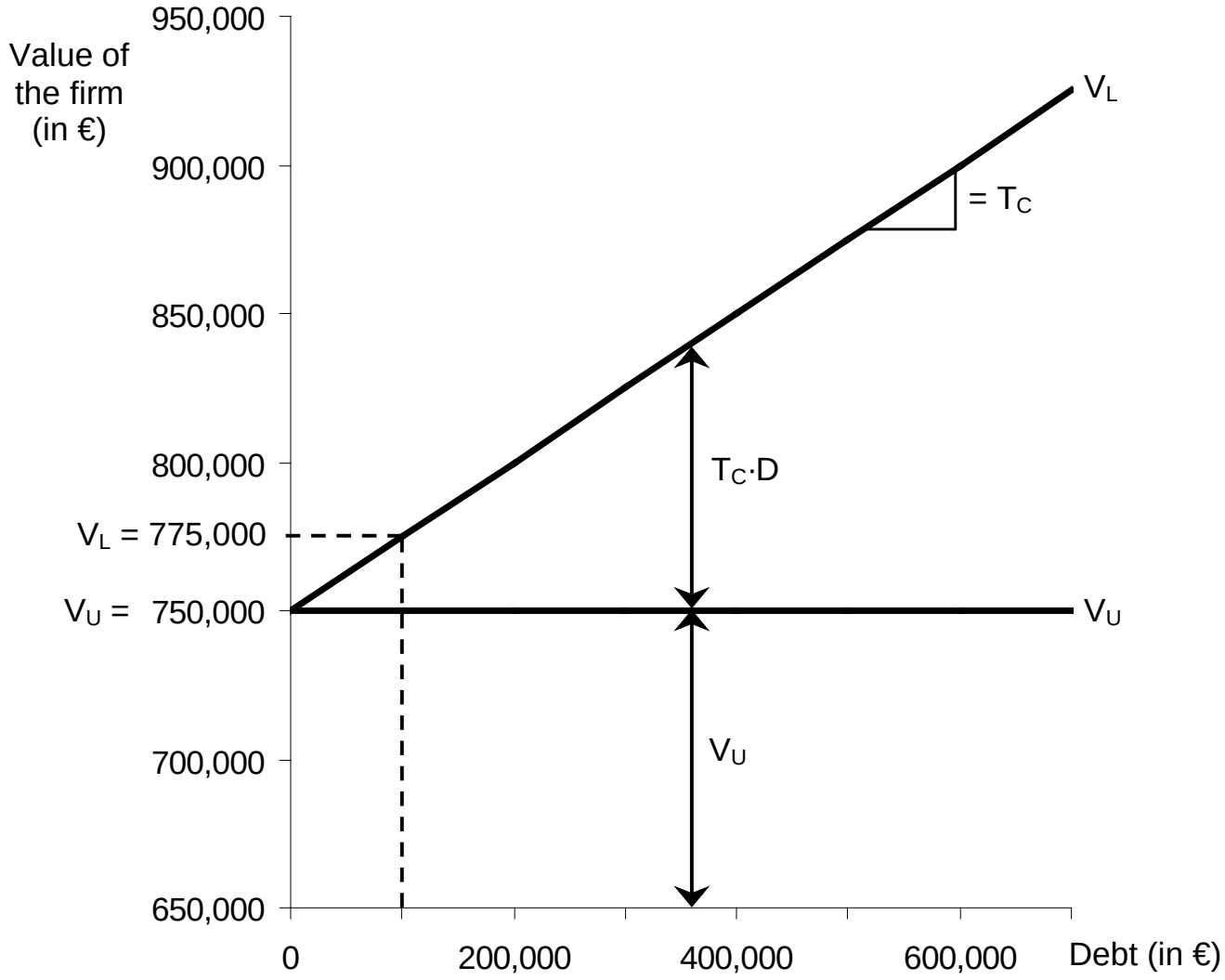

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- **Implication**: corporations should **borrow to the absolute maximum**. However, we immediately reach the **illogical conclusion** that the optimal capital structure is 100% debt.

❍ M&M Proposition II with corporate taxes (cost of capital):

Once we consider the effect of corporate taxes, the WACC is:

$$WACC = \left(\frac{E}{V}\right) \cdot R_E + \left(\frac{D}{V}\right) \cdot R_D \cdot (1 - T_C)$$

M&M Proposition II with corporate taxes states that the cost of equity is:

$$R_E = R_U + (R_U - R_D) \cdot \left(\frac{D}{E}\right) \cdot (1 - T_C)$$

Firm L is worth €775,000, debt is worth €100,000 ➔ equity is worth €675,000

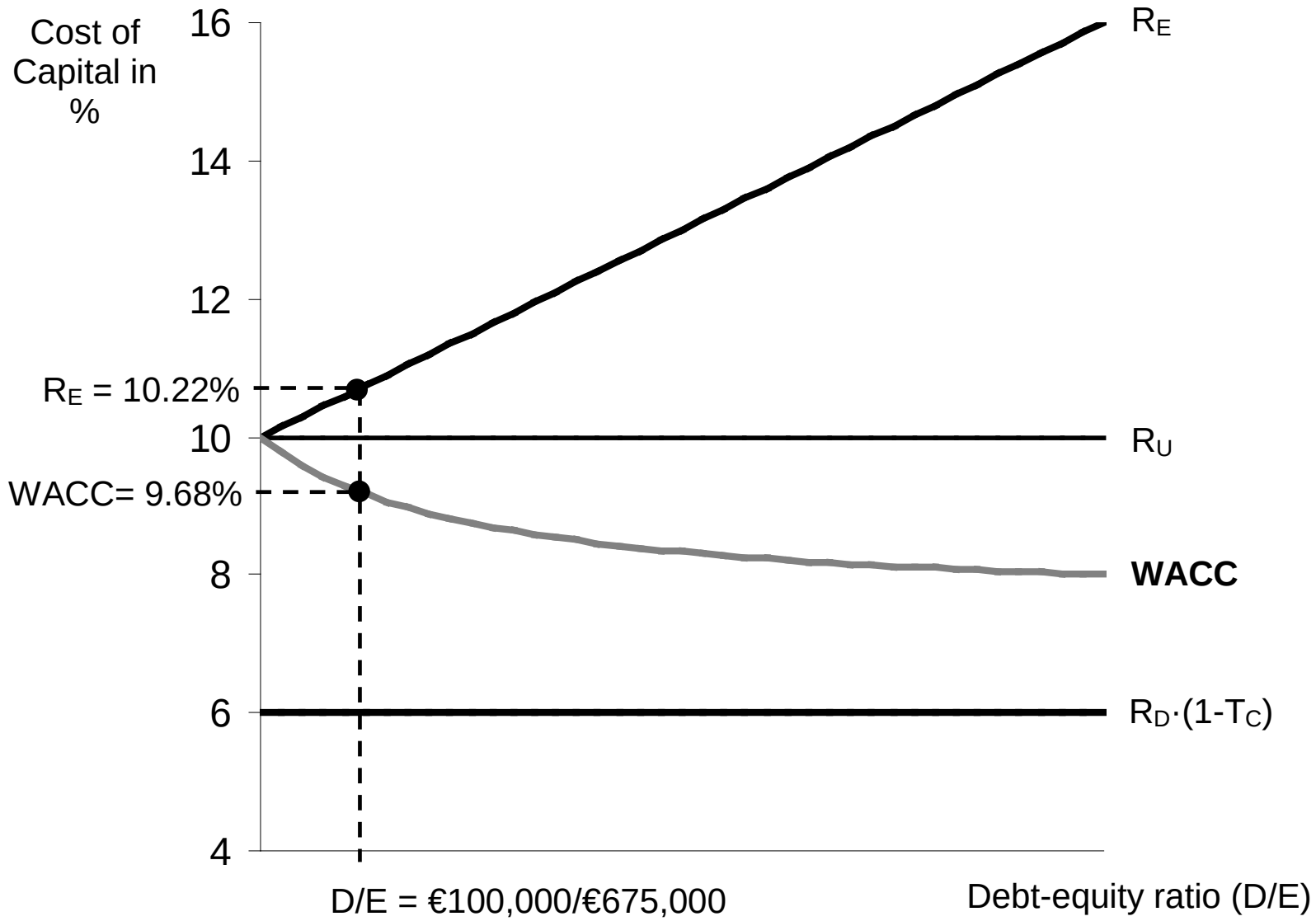
For firm L, the cost of equity is, thus:

$$R_E = 0.1 + (0.1 - 0.08) \cdot \left(\frac{€100{,}000}{€675{,}000} \right) \cdot (1 - 0.25) = 10.22\%$$

And the WACC is:

$$WACC = \left(\frac{€675{,}000}{€775{,}000} \right) \cdot 10.22\% + \left(\frac{€100{,}000}{€775{,}000} \right) \cdot 8\% \cdot (1 - 0.25) = 9.68\%$$

Without debt, the WACC is 10%, and with debt, it is 9.68%. Therefore, the firm is better off with debt.



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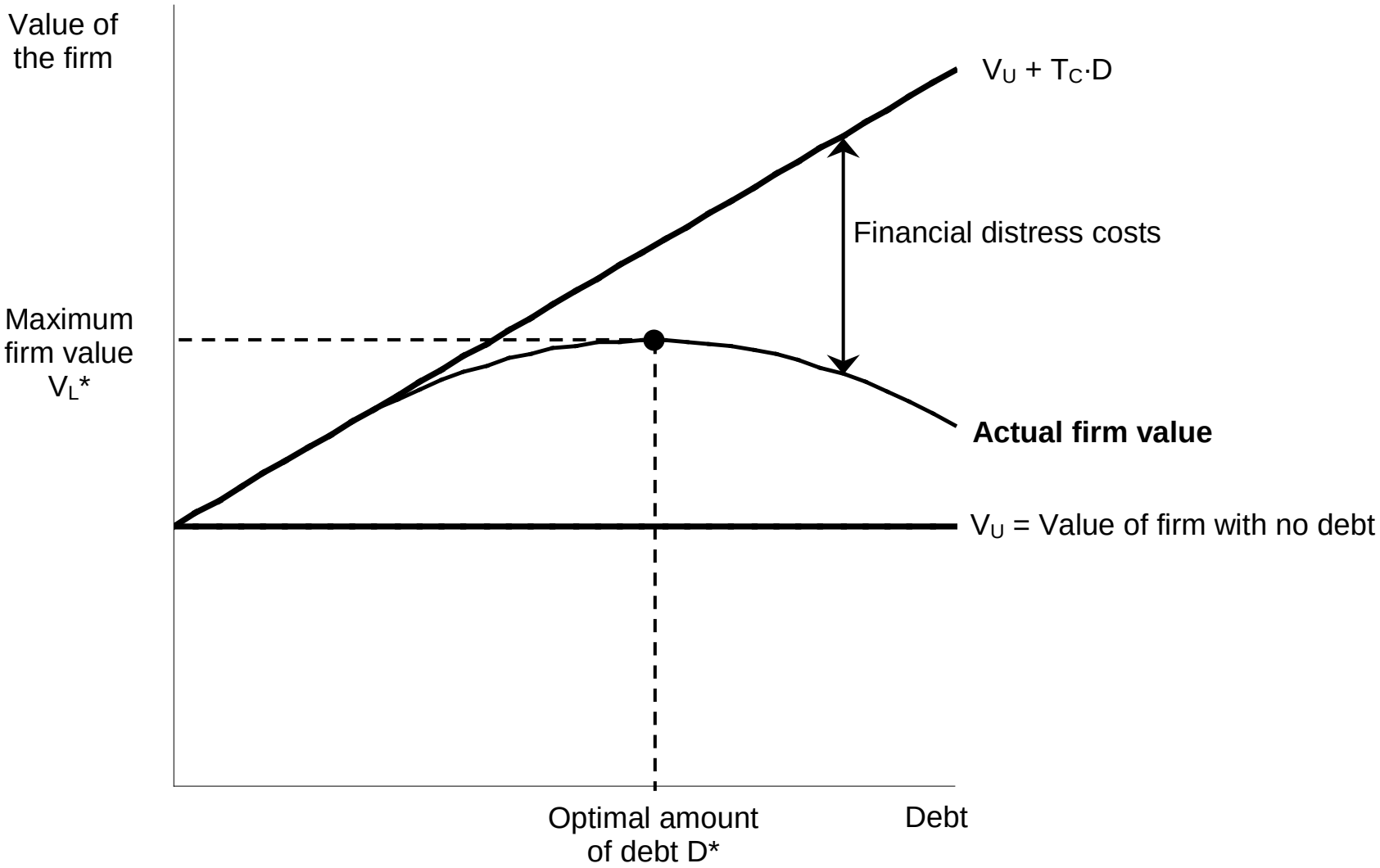
4. M&M Propositions with Corporate Taxes and Bankruptcy Costs

- At relatively **low debt levels**:
  - The probability of bankruptcy and financial distress is low
  - The benefit from debt outweighs the cost.

- At **higher debt levels**:
  - The possibility of financial distress is larger
  - The benefit from debt financing may be more than offset by the financial distress costs
    - ➔ Assets of such a firm will lose value because the management is busy trying to avoid bankruptcy instead of running the business.
    - ➔ Normal operations may be disrupted and sales are lost.
    - ➔ Valuable employees leave
    - ➔ Potentially fruitful programs are dropped to preserve cash
    - ➔ Otherwise profitable investments are not taken
    - ➔ Lose of customers
    - ➔ Higher cost of debt

The Static Theory of Capital Structure



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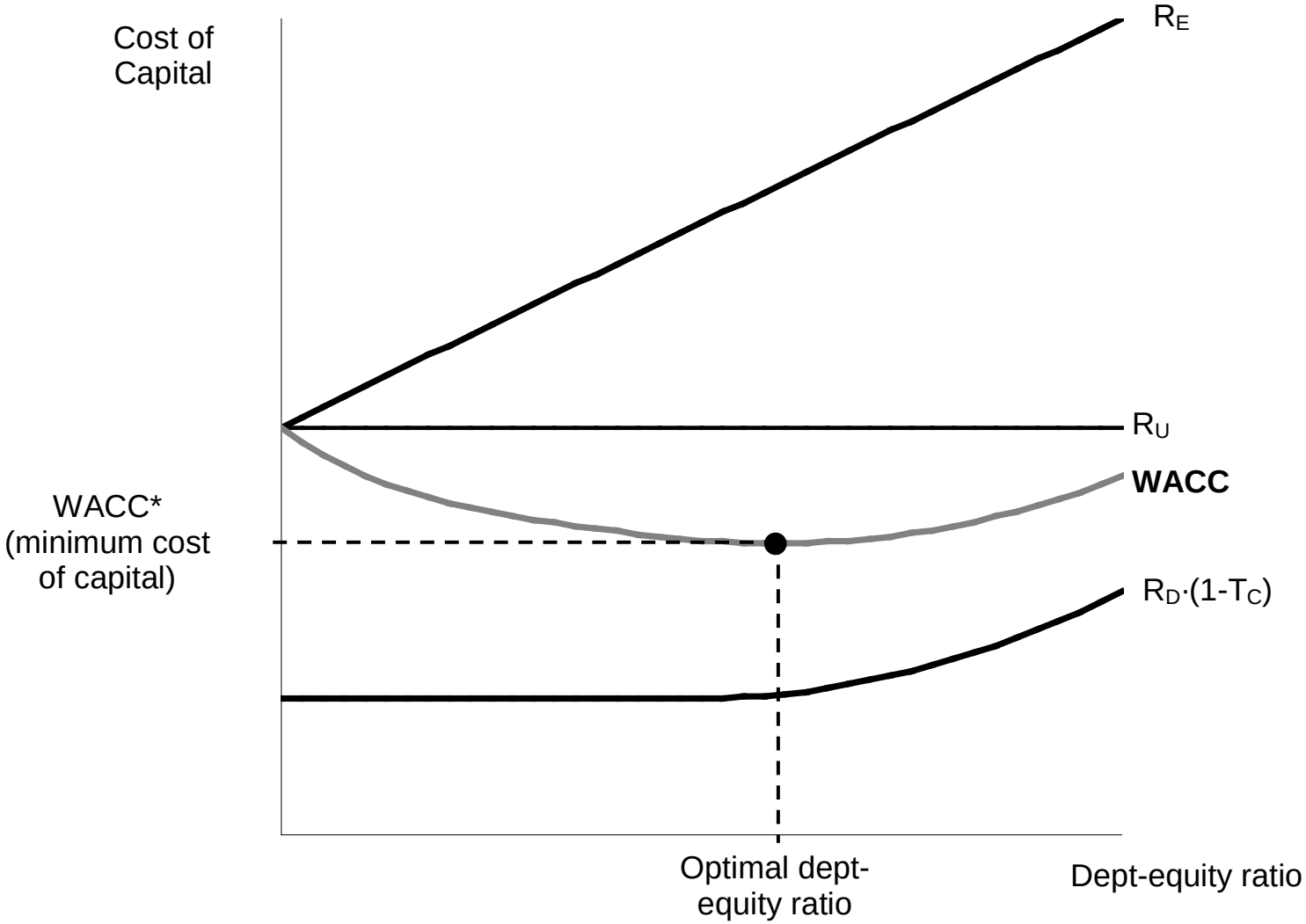
Optimal Capital Structure and the Cost of Capital



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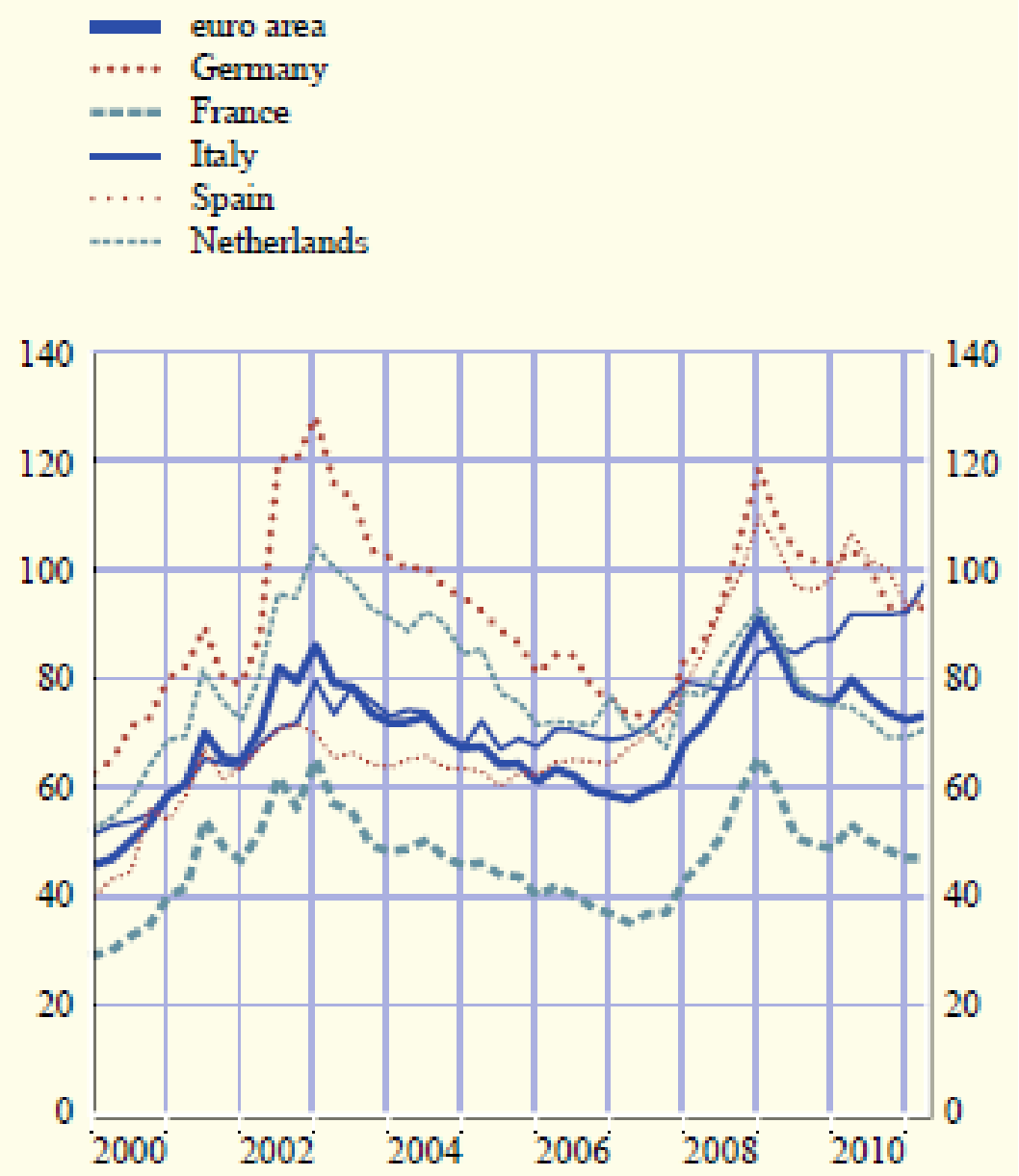
5. Real Capital Structures

❍ Europe

Debt-to-Equity (D/E) Ratio (in %)

Non-Financial Corporations

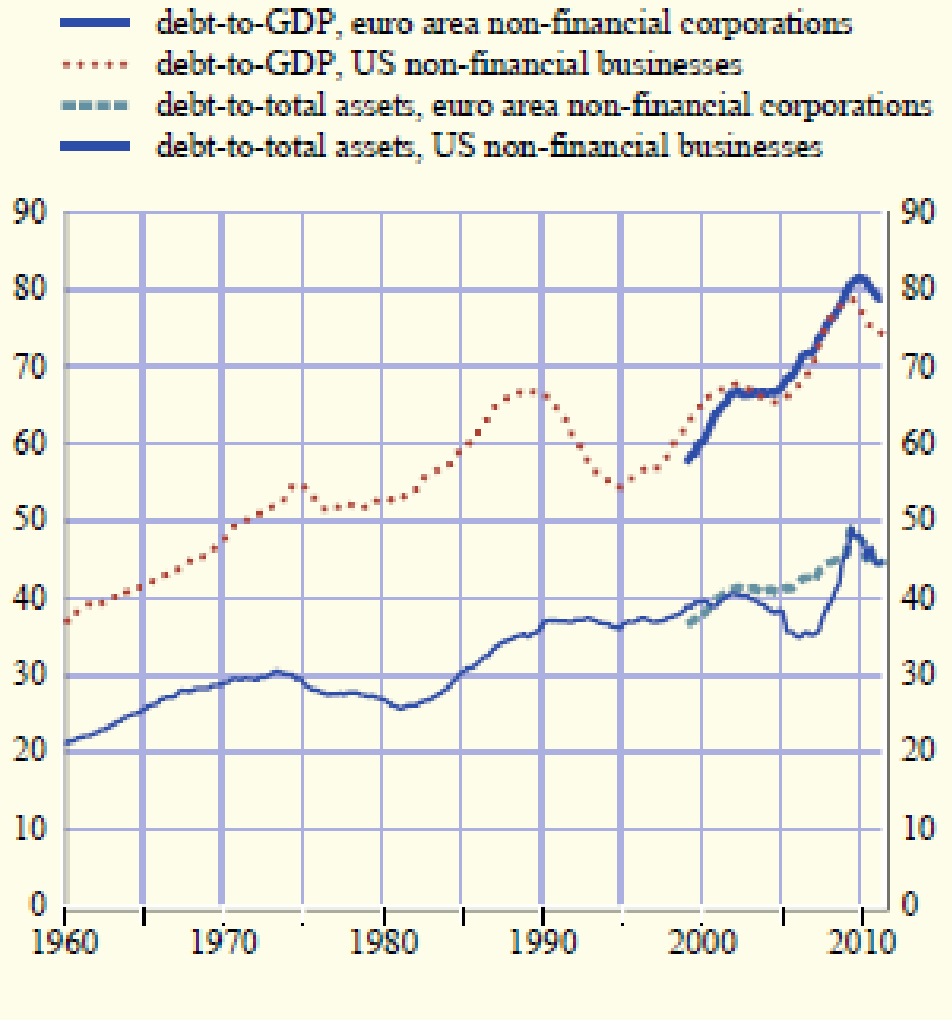


Source:
Corporate indebtedness in the Euro area, ECB-Monthly Bulletin, February 2012, pp. 87-103.

❍ US vs Euro area

Debt Ratios (D/(E+D)) (in %)

Non-Financial Corporations



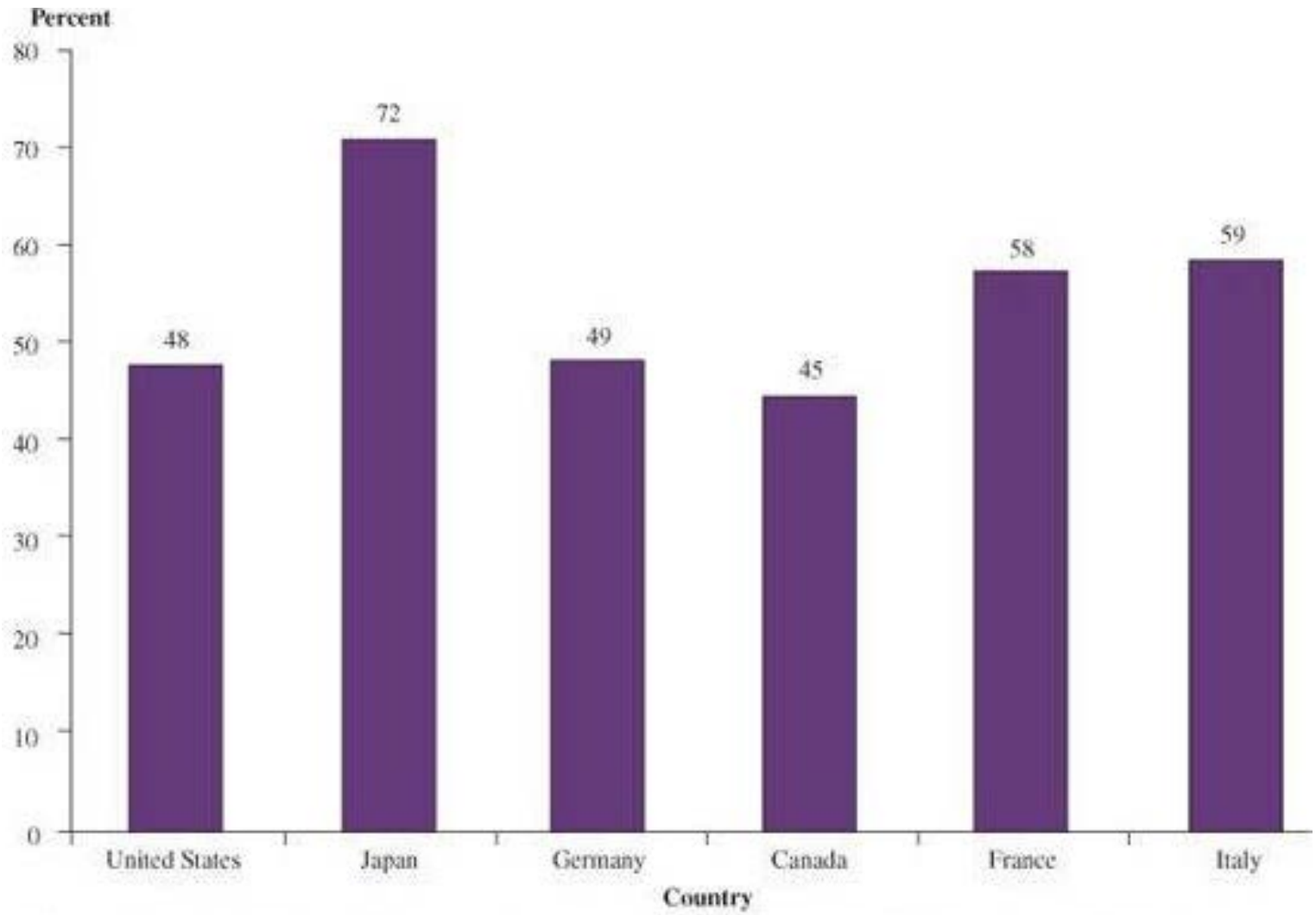
Sources: Bureau of Economic Analysis, Board of Governors of the Federal Reserve System and ECB.
Notes: Debt excludes inter-company loans. For the euro area, assets have been consolidated with inter-company loans, shares and other accounts (excluding trade credit receivables). Shares and other equity (excluding mutual fund shares) and other accounts (without trade credit) were netted in the definition of assets, as these are not included in the US data.

Source:
Corporate indebtedness in the Euro area, ECB-Monthly Bulletin, February 2012, pp. 87-103.

❍ Global

Debt Ratios

Non-Financial Firms



Definition: Debt is short-term debt plus long-term debt. Total value is debt plus equity (in book value terms).

Source:
Ross, Westerfield, and Jaffe (2010): Corporate Finance, 9th edition, McGraw-Hill-Irwin, pp. 588.

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❍ US

Debt Ratios (%)

Non-Financial Firms
(5 year average)

	Debt as a Percentage of the Market Value of Equity and Debt (Industry Medians)
High Leverage	
Air transport	57.9
Television broadcasting stations	54.0
Hotels and lodging	44.2
Natural gas distribution	41.8
Building construction	40.4
Low Leverage	
Educational services	7.8
Drugs	6.8
Biological products	5.9
Electronics	3.3
Computers	1.6

DEFINITION: Debt is the total of short-term debt and long-term debt.

SOURCE: Ibbotson 2008 *Cost of Capital Yearbook* (Chicago: Morningstar, 2008).

Source:
Ross, Westerfield, and Jaffe (2010): Corporate Finance, 9th edition, McGraw-Hill-Irwin, pp. 589.