Module 9

WACC, Capital Structure, and Debt Policy

FINE 3010, Financial Management
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Goals

- What is the relation between a firm's **cost of capital** and its **capital structure**?
  - **Cost of capital**, the expected return a company's investors could earn on securities with comparable risk
  - **Capital structure**, the **mix** of financing for a business (the proportions of debt, preferred stock, common stock, . . .)

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- In this module (textbook chapters 13 and 16),
  - **Part 1**, the weighted average cost of capital (WACC), the discount rate for capital budgeting
  - **Part 2**, debt policy and the irrelevance of capital structure (Modigliani and Miller)
  - **Part 3**, taxes and financial distress, the trade-off theory

Module 9, Part 1

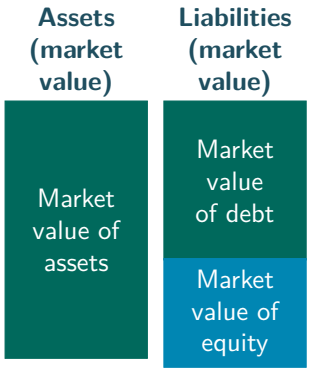
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Market Value Balance Sheet

- The balance sheet identity of **Module 2**, assets = liabilities + shareholders' equity, at book values

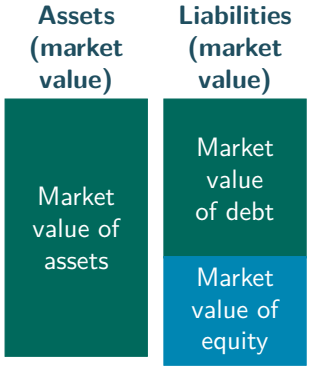
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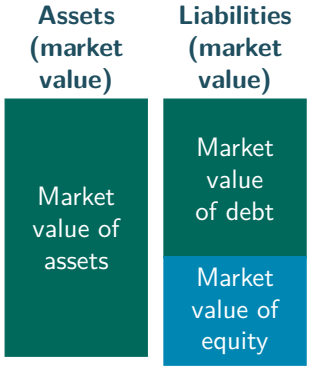
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- **Market value of assets**, the present value of the firm's future cash flows to **all investors** combined
- Market value of debt, often approximated by its book value (close, not the same)
- Market value of equity, the market capitalization (often far from its book value)



Weighted Average Cost of Capital

- **WACC**, the expected rate of return on a portfolio of all the firm's securities, adjusted for the tax savings from the interest tax shield,

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- A weighted average of the cost of debt and the cost of equity, with an adjustment for the interest tax shield
- Note the $(1-\tau)$ term, with a corporate tax rate τ, each dollar of debt effectively costs the firm only $(1-\tau) \times r_d$, because debt provides a tax shield of $\tau \times r_d$ (**Module 2**)

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- r_e, the **required return on equity**
  - Approximated with the CAPM of **Module 8**, $r_{e,i} = r_f + \beta_i(r_{\text{mkt}} - r_f)$

Example, Weighted Average Cost of Capital

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	$ millions	Share
Market value of debt	194	30%
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- Solution,

$$r_{\text{wacc}} = \frac{D}{V}(1-\tau)\, r_d + \frac{E}{V}\, r_e = 0.30 \times (1 - 21\%) \times 8\% + 0.70 \times 14\% = 11.7\%$$

Why Do We Learn about WACC?

- You run a firm with no debt and no equity, and face a project that requires a $100 investment
- The project is expected to generate a cash flow of $120 one year later, before accounting for the interest tax shield (that is, assuming all-equity financing)

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- You raise the \$100 by issuing \$70 of equity and \$30 of debt, the debt matures in one year
- Should you go ahead with the project?
- Solution, shareholders put \$70 into the firm and expect to get, one year later,

$$\$120 - r_d \times \$30 + r_d \times \tau \times \$30 - \$30$$

- where $r_d \times \tau \times \$30$ is the interest tax shield

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- That is, shareholders vote for the project if its return beats the WACC. Using the WACC as the opportunity cost of capital in capital budgeting, and accepting projects that return more than it, maximizes shareholder value!

WACC Examples

- Calculation assumptions for the table on the next frames,
  - $r_{e,i} = 1\% + \beta_i \times 7\%$, that is, $r_f = 1\%$ and $r_{\text{mkt}} - r_f = 7\%$

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  - $r_{\text{wacc}} = \dfrac{D}{V}(1-\tau)\, r_d + \dfrac{E}{V}\, r_e$

WACC Examples

Ticker	Company	Beta	r_e (%)	r_d (%)	E/V	D/V	WACC (%)
X	U.S. Steel	3.03	22.2	5.7	0.34	0.66	10.5
MRO	Marathon Oil	2.35	17.4	2.3	0.40	0.60	8.1
AMZN	Amazon	1.51	11.5	1.5	0.96	0.04	11.1
IBM	IBM	1.33	10.3	1.6	0.65	0.35	7.2
BA	Boeing	1.19	9.3	2.9	0.81	0.19	8.0
F	Ford	1.09	8.6	3.5	0.22	0.78	4.1
UNP	Union Pacific	1.07	8.5	1.9	0.84	0.16	7.4
GOOG	Alphabet	1.01	8.1	1.5	0.99	0.01	8.0
DIS	Disney	1.00	8.0	1.9	0.86	0.14	7.1
XOM	ExxonMobil	1.00	8.0	1.5	0.84	0.16	6.9

Expected return on equity r_e, interest rate on debt r_d, and the proportions of equity and debt at market values (Brealey, Myers, and Marcus, Table 13.4)

WACC Examples

Ticker	Company	Beta	r_e (%)	r_d (%)	E/V	D/V	WACC (%)
INTC	Intel	0.91	7.3	1.6	0.89	0.11	6.7
PFE	Pfizer	0.65	5.6	1.5	0.85	0.15	4.9
PCG	Pacific Gas & Electric	0.55	4.9	2.9	0.45	0.55	3.5
SBUX	Starbucks	0.51	4.5	2.1	0.90	0.10	4.3
MCD	McDonald's	0.45	4.1	2.1	0.78	0.22	3.6
CPB	Campbell Soup	0.43	4.0	2.9	0.73	0.27	3.5
KO	Coca-Cola	0.43	4.0	1.6	0.88	0.12	3.7
WMT	Walmart	0.35	3.5	1.5	0.86	0.14	3.1
NEM	Newmont Mining	−0.01	0.9	2.3	0.88	0.12	1.0

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  - Unlike interest, preferred dividends are not tax-deductible
  - No voting rights

WACC and Preferred Stock

- With preferred stock, using market values throughout,

$$r_{\text{wacc}} = \frac{D}{V}(1-\tau)\, r_d + \frac{P}{V}\, r_p + \frac{E}{V}\, r_e, \qquad V = D + P + E$$

- where P is the market value of the preferred stock and r_p its required return

Example, WACC and Preferred Stock

- A firm has issued debt, preferred stock, and common stock, with market values of \$4 million, \$2 million, and \$6 million, and required returns of 6%, 12%, and 18%. What is its WACC with a 21% corporate tax rate?

Example, WACC and Preferred Stock

- A firm has issued debt, preferred stock, and common stock, with market values of \$4 million, \$2 million, and \$6 million, and required returns of 6%, 12%, and 18%. What is its WACC with a 21% corporate tax rate?
- Solution, the total value is $\$4\text{m} + \$2\text{m} + \$6\text{m} = \$12$ million,

$$r_{\text{wacc}} = \frac{D}{V}(1-\tau)\, r_d + \frac{P}{V}\, r_p + \frac{E}{V}\, r_e = \frac{4}{12}(1-0.21)\, 0.06 + \frac{2}{12}\, 0.12 + \frac{6}{12}\, 0.18 = 12.58\%$$

Interpreting WACC

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- The benchmark may be adjusted upward for unusually (systematically) risky projects and downward for unusually safe ones
- E.g., an electricity provider with both regulated businesses (not cyclical, low systematic risk) and merchant businesses (cyclical, large systematic risk), as in **Module 8**

Recap of Part 1

- The balance sheet identity holds at market values, and the WACC is the expected return on the portfolio of all the firm's securities, with the interest tax shield netted out of the cost of debt

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- Use market values, the yield for r_d, and the CAPM for r_e
- Projects that return more than the WACC raise shareholder value, so the WACC is the capital budgeting discount rate for average-risk projects

Key Takeaways

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- The WACC weights the after-tax cost of debt and the cost of equity at market values, and is the discount rate for the firm's average-risk projects
- In perfect capital markets capital structure is irrelevant (M&M), leverage raises the expected return on equity and its risk together
- Taxes make debt valuable through the interest tax shield, financial distress makes it costly, and the trade-off theory balances the two

Thank you!

Please let me know if you have any questions.