Corporate Investment Policy: A Review

Professor Lu Zhang

William E. Simon Graduate School of Business Administration

University of Rochester

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Outline

- Unlevered cash flows, the risk-adjusted discount rate method
- The comparison approach, the effect of leverage on comparison
- Implied cost of capital
- Corporate taxes and cost of capital
- The adjusted present value, APV
- The weighted average cost of capital, WACC

Unlevered Cash Flows

- Unlevered cash flows are generated directly from the real assets of the project/firm
- In a frictionless world where financing does not affect the operations, unlevered cash flows are those with all-equity financing
- Financing cash flows are associated with (i) issuance or retirement of debt and equity (ii) interest or dividend payments (iii) any interest-based tax deductions from debt financing
- Deriving unlevered cash flows from the accounting cash flow statement

- Unlevered cash flow = operating cash inflow + investing cash inflow (usually negative) + debt interest - debt interest tax subsidy

- Example 9.1. On December 31, 1998, Exxon before its merger with Mobil reported the following figures (in millions) in its cash flow and income statements:

Net cash inflow from operations	11,056
Net cash inflow from investing	(7,992)
Interest expenses	100

  Exxon's state plus federal marginal tax rate is 40%. Then its unlevered cash flow = 11,056 - 7,992 + 100 - 40 = \$3,124 millions

- Growth firms tend to have negative unlevered cash flows despite high profitability

- Valuation methods using unlevered cash flows, unfit for financial companies because of high financing cash flows not accounted in unlevered cash flows

- Unlevered cash flow = EBIT + depreciation and amortization - change in working capital - capital expenditures + sales of capital assets - EBIT $\times$ tax rate

The Risk-Adjusted Discount Rate Method

- Discount the expected future cash flows at the project's cost of capital, expected cash flow as the probability-weighted sum of cash flows in each scenario, the cost of capital as the expected return investors require for holding an investment with the same risk as the project

- Algorithm, to find the PV of next period's cash flow: (1) compute the expected cash flow, $E(\widetilde{C})$; (2) compute the beta of the return of the project, β; (3) compute cost of capital by substituting beta into an asset pricing model, e.g., CAPM; (4) $PV = \frac{E(\widetilde{C})}{1+r_f+\beta(\overline{R}_T - r_f)}$, where $\overline{R}_T$ is the average return of the tangency portfolio

- Example 11.1: Using the cost of capital to value a non-traded subsidiary
- The non-traded subsidiary has a beta of 1.2
- In a year, the subsidiary will be worth \$10 per share with a .9 probability, and will be worth \$20 with a .1 probability
- The risk free rate is .09
- The tangency portfolio has an expected return of 19%, PV(subsidiary) = ?
- The expected cash flow $= .9 \times \$10 + .1 \times \$20 = \$11$ per share
- The discount rate $= .09 + 1.2 \times (.19 - .09) = 21\%$
- PV(subsidiary) $= \frac{\$11}{1.21} = \$9.09$ per share

The Comparison Approach

- How to get the beta for a non-traded asset?
- Analyze (average) the betas of traded securities from firms in the same line of business (comparison) as the project
- The comparison approach assumes that the beta risk of the project is comparable to those of comparison firms. But because leverage affects betas, we need to adjust for debt financing to make beta comparisons
- Two firms, different leverage, but same operations

- Balance sheet for an all-equity firm

Assets	Liabilities and equity
A	Debt $= 0$
	Equity $= E$

- Balance sheet for a levered firm

Assets	Liabilities and equity
A	Debt > 0
	Equity $= E$

- For the levered firm:

$$\begin{aligned} \widetilde{r}_A &= \left[\frac{D}{D+E}\right]\widetilde{r}_D + \left[\frac{E}{D+E}\right]\widetilde{r}_E \quad \Rightarrow \quad \widetilde{r}_E = \left[1+\frac{D}{E}\right]\widetilde{r}_A - \left[\frac{D}{E}\right]\widetilde{r}_D \\ \beta_A &= \left[\frac{D}{D+E}\right]\beta_D + \left[\frac{E}{D+E}\right]\beta_E \quad \Rightarrow \quad \beta_E = \left[1+\frac{D}{E}\right]\beta_A \end{aligned} \tag{1}$$

- Exhibit 11.4: Equity beta as a function of the firm's leverage ratio

- Result 11.4: The cost of equity,

$$\overline{r}_E = \overline{r}_A + (D/E)(\overline{r}_A - \overline{r}_D)$$

  increases as leverage rises.

- Exhibit 11.5: Cost of debt, cost of equity, and cost of capital

- If a project and its comparison firms are financed differently, we need to adjust the comparison's beta for the leverage difference

Exhibit 11.4: Equity Beta as a Function of the Firm's Leverage Ratio

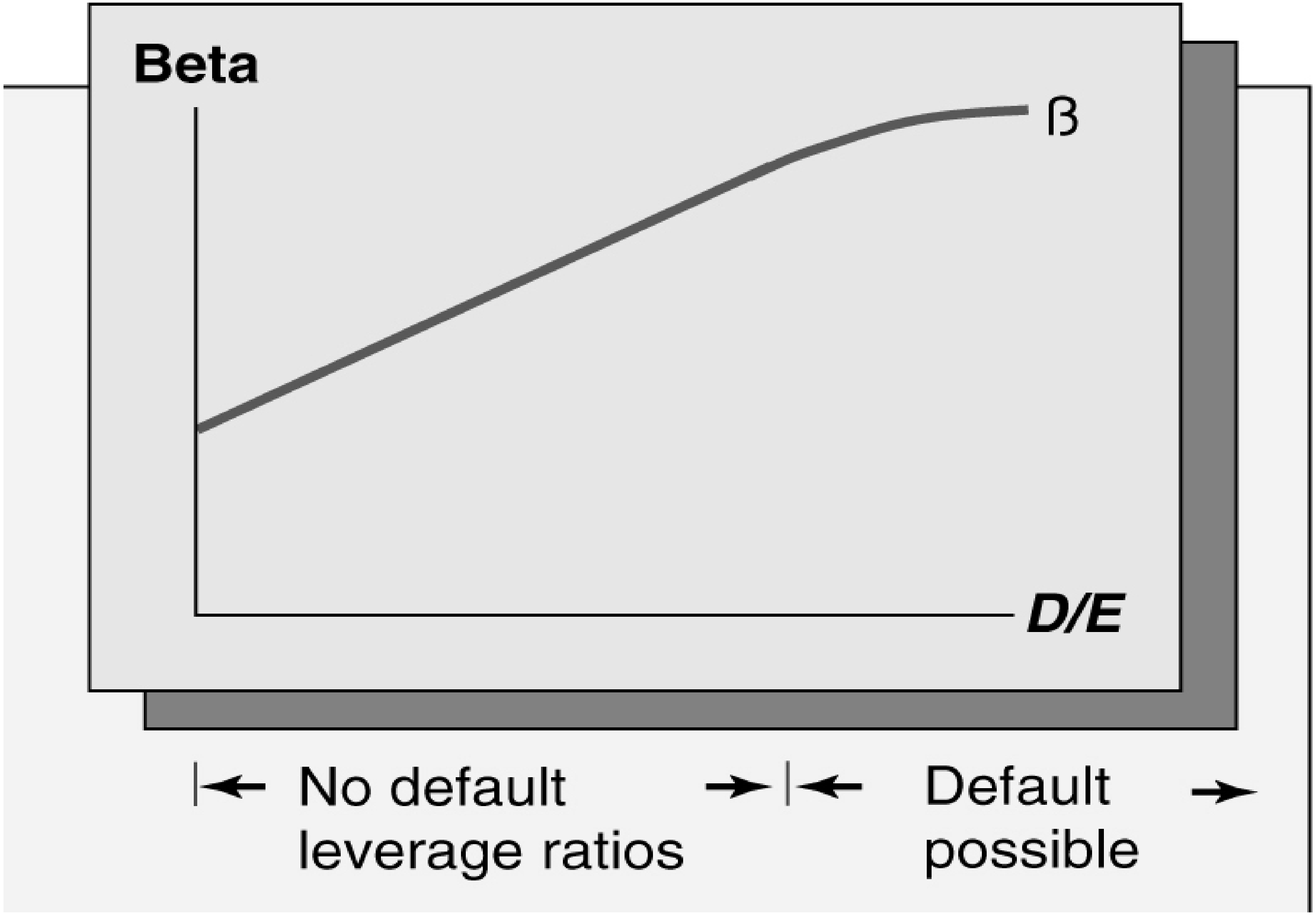
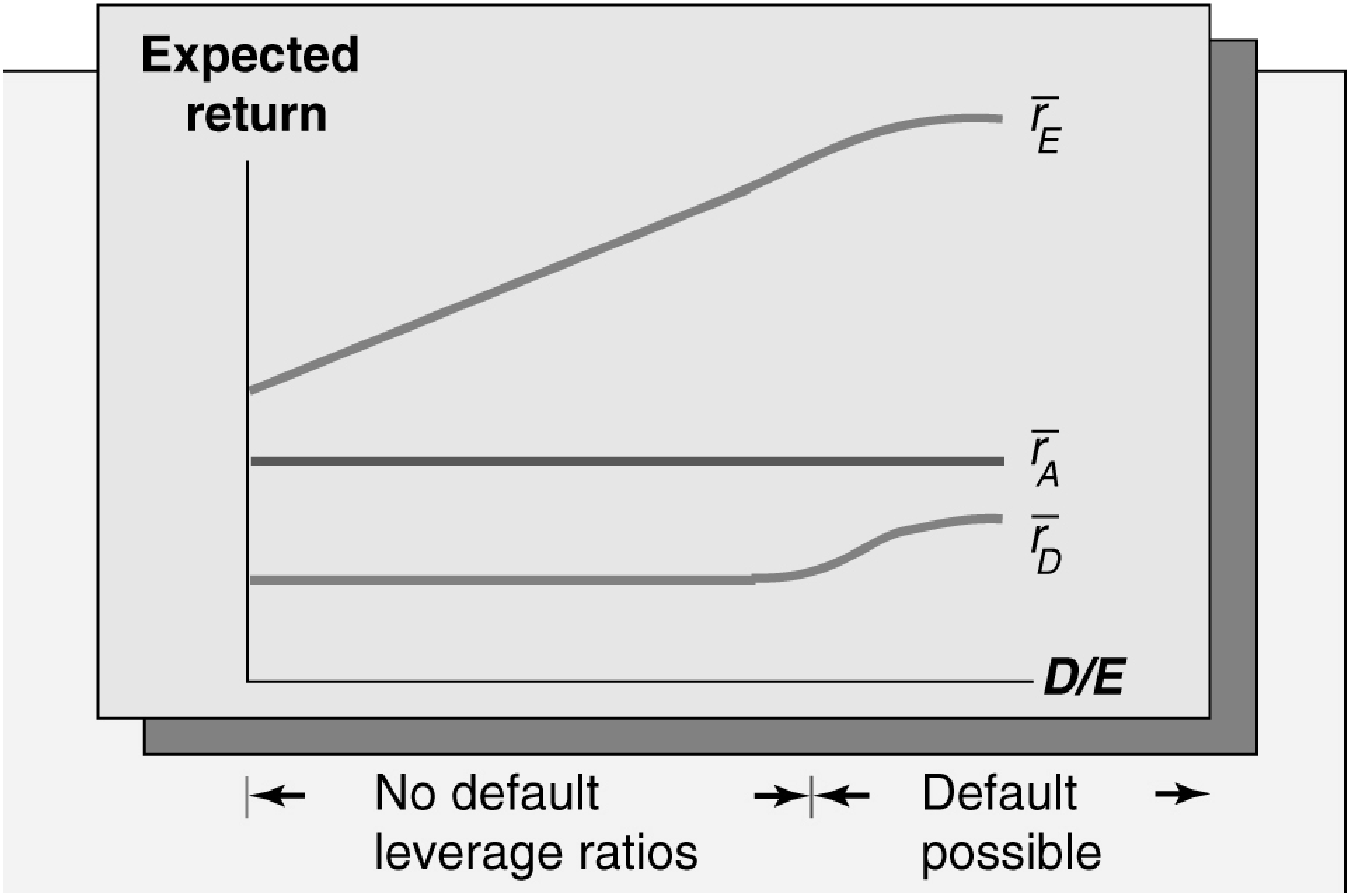


Exhibit 11.5: Cost of Debt, Equity, and Capital as a Function of D/E



- Example 11.2 (necessary leverage adjustment without taxes): Marriott has identified three comparison firms for its restaurant division:

	β_E	D(\$billions)	E(\$billions)
Church′s Chicken	0.75	0.004	0.096
McDonald′s	1.00	2.300	7.700
Wendy′s	1.08	0.210	0.790

The risk free rate is 4%, market risk premium is 8.4%, CAPM holds, the comparison firms' debt is risk free. What is the cost of capital for Marriott's restaurant?

- From equation (1), asset betas, β_A, for the three comparisons are, respectively, $.096/.100 \times .75 = .72, 7.7/10 \times 1.00 = .77, .79/1.0 \times 1.08 = .85$. β_A for Marriott is then the average $(.72 + .77 + .85)/3 = .78$. Applying the CAPM, the cost of capital for the restaurant division $= .04 + .78(.084) = .1055$

Implied Cost of Capital

- Costs of capital from CAPM/APT are imprecise, Fama and French (1997)

- An alternative approach is the so-called implied cost of capital from Dividend Discount Model; a special case is the Gordon Growth Model,

$$S_0 = \frac{D_1}{\overline{r}_E - g} \qquad \Rightarrow \qquad \overline{r}_E = g + \frac{D_1}{S_0}$$

  where D_1 is expected dividend per share one year from now; S_0 is current stock price per share; $\overline{r}_E$ is cost of equity; g is the expected dividend growth

- $\frac{D_1}{S_0}$, estimated as a historical average over prior five years of the ratio of dividend per share divided by prior year price per share

- g, analysts' forecasts of earnings growth, assuming constant payout ratios

- Alternatively, estimate g using the plowback ratio formula

$$g = b \times ROE$$

where b is the plowback ratio, the fraction of earnings retained in the firm, ROE is return on equity, earnings over last year's book equity

Corporate Taxes and Cost of Capital

- Having analyzed how leverage affects cost of capital, what about corporate taxes?
- Balance sheet for a levered firm when debt interest is corporate-tax deductible

Assets	Liabilities and equity
Debt tax shield$(TX) = T_c D$	Debt $= D$
Unlevered assets$(UA) = D + E - T_c D$	Equity $= E$

UA: present value of the unlevered cash flows; TX: present value of the debt-interest deduction for all corporate profits taxes; T_c: effective corporate tax rate

- The assets beta (or expected return) is the portfolio-weighted average of the betas (or expected returns) of the unlevered assets and debt tax shields:

$$\beta_A = \left[\frac{UA}{D+E}\right]\beta_{UA} + \left[\frac{TX}{D+E}\right]\beta_{TX}$$
$$\overline{r}_A = \left[\frac{UA}{D+E}\right]\overline{r}_{UA} + \left[\frac{TX}{D+E}\right]\overline{r}_{TX}$$

- Assume static perpetual risk-free debt, then $\beta_{TX} = \beta_D = 0$ and

$$\beta_A = \left[\frac{UA}{D+E}\right]\beta_{UA} = \left[\frac{D+E-T_cD}{D+E}\right]\beta_{UA} \tag{2}$$

The beta of the combination of the unlevered assets and the debt tax shield declines with leverage to reflect the addition of the riskless tax savings

- Recall with riskless debt, $\beta_E = \frac{D+E}{E}\beta_A$, combining with equation (2) implies:

$$\beta_E = \left[\frac{D+E}{E}\right]\left[\frac{D+E-T_cD}{D+E}\right]\beta_{UA} = \left[1+(1-T_c)\frac{D}{E}\right]\beta_{UA}$$

For a given debt increase, the equity beta increases less the larger is the corporate tax rate, and increases the most without taxes

- Unlevering the equity beta of comparison firms in the presence of corporate taxes:

$$\beta_{UA} = \frac{\beta_E}{\left[1+(1-T_c)\frac{D}{E}\right]} \tag{3}$$

Rationale: when debt tax shields exist, it is the betas and expected returns of the unlevered assets of comparison firms, not their assets, that are perceived as being similar to those of the project being valued

- Example 13.1, using the comparison method to obtain beta and $\overline{r}$ with taxes.

- Continue with the setup in Example 11.2, and the corporate tax rate is 34%

- From equation (3), unlever asset betas, β_{UA}, for the three comparison firms are $.75/(1 + .66(.004/.096)) = .73$; $1.00/(1 + .66(2.3/7.7)) = .84$; $1.08/(1 + .66(.21/.79)) = .92$, respectively. Marriott's unlevered asset beta is the average, .83. Its cost of capital is then $.04 + .83(.084) = .1097$

- Caveat in equation (3), unrealistic assumptions (i) perpetual debt; (ii) default free, risk-free; (iii) constant face value of the debt and tax rate

Introduction to APV and WACC

- Cash flows can arise from both assets and liabilities side of the balance sheet, given the mix of debt and equity, how to value investments?
- The adjusted present value method, APV, superior, flexible: (i) forecasting a project's unlevered cash flows (ii) value the unlevered cash flow with all equity financing (iii) add the value of tax shield and other subsidies
- The weighted average cost of capital, WACC, widely adopted: (i) estimate a project's expected unlevered cash flows (ii) discount the expected unlevered cash flow at a single discount rate adjusted for risk and leverage

The Adjusted Present Value Model, APV

- Discount expected unlevered cash flows at $\overline{r}_{UA}$ with risk β_{UA}; value the debt tax shield with the riskless rate; add up

- Exhibit 13.2, sources of shareholder values

- Transfers from existing bondholders, e.g., asset substitution, more to come later

- Example 13.2, United Technologies is considering a project that has a cost of capital of 14% if financed with only equity. The unlevered cash flows in the next four years are, \$100, \$100, \$1,000, and \$1,000 millions, respectively.

Exhibit 13.2: Sources of Shareholder Value

Total Increase in Shareholder Value

Present value of unlevered cash flows (after-tax cash flows assuming all-equity financing)	Present value of financing subsidies (like debt tax shields)	Transfers to or from existing debt holders (can be positive or negative)

- In Years 1, 2, the project is financed with equity only. In the start of Year 3, the firm borrows \$2 billions to finance the project for the last two years. The borrowing rate is 8%, and corporate tax rate is 34%.

- How to value the project using APV?

- The PV for the unlevered cash flows at a discount rate of 14% is \$1,1431.72 million $(= 100/1.14 + 100/1.14^2 + 1000/1.14^3 + 1000/1.14^4)$

- The PV of the debt tax shields is \$83.17 million $(= .34(.08 \times \$2\,\text{billion})/1.08^3 + .34(.08 \times \$2\,\text{billion})/1.08^4)$

- Summing up yields the total PV = \$1,514.89 million

WACC

- The WACC method discounts unlevered cash flows and account for debt tax shields by adjusting the discount rate to WACC:

$$\text{WACC} = \frac{E}{D+E}\overline{r}_E + \frac{D}{D+E}(1 - T_c)\overline{r}_D \tag{4}$$

where $(1 - T_c)\overline{r}_D$ is the expected after-tax cost of debt

- Example 13.8, UT consists of 20% debt and 80% equity. The firm can borrow at a riskless rate of 8%. The interest expense is tax deductible, the corporate tax rate is 34%. The CAPM holds, the market expected return is 14%, UT's equity beta is 1.2, WACC = ?

- From the CAPM, UT's cost of equity, $\overline{r}_E = 8\% + 1.2(14\% - 8\%) = 15.2\%$, the after-tax cost of debt $\overline{r}_D(1 - T_c) = 8\%(1 - .34) = 5.28\%$. Thus, WACC $= .8 \times 15.2\% + .2 \times 5.28\% = 13.2\%$.

- From equation (4), WACC $= \overline{r}_A$ when $T_c = 0$

  Result 13.3: In the absence of taxes and other market frictions, WACC equals the unlevered cost of capital, and is independent of leverage

- Rewriting equation (4),

$$\text{WACC} = \frac{E}{D+E}\overline{r}_E + \frac{D}{D+E}\overline{r}_D - \frac{D}{D+E}T_c\overline{r}_D = \overline{r}_A - \frac{D}{D+E}T_c\overline{r}_D \qquad (5)$$

  Result 13.4: With tax-deductible debt interests, WACC declines as leverage rises

- Exhibit 13.5, WACC, cost of equity, cost of debt, and $\frac{D}{E}$ with taxes

Exhibit 13.5: WACC, Cost of Equity, and Cost of Debt vs. $\frac{D}{E}$ with Corporate Taxes