Principles of Finance

Financing and valuation

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Financing and valuation

- In deciding to raise financing for a business, is there an optimal mix of debt and equity?
  - If yes, what is the trade off that lets us determine this optimal mix?
  - If not, why not?
- Consider the case of Dan Harris, CFO of Electronic Business Services (EBS), who has been reviewing plans for a major expansion of the firm
- To pursue the expansion, EBS plans to raise $50 million from outside investors

Financing and valuation

□ One possibility is to sell shares of EBS stock. Due to the firm's risk, Dan estimates that equity investors will require a 10% risk premium over the 5% risk-free interest rate

□ Some senior executives at EBS, however, argue that EBS should consider borrowing the $50 million instead. EBS has not borrowed previously and should be able to borrow at 6%

□ Does the low interest rate make debt a better choice for EBS?

□ If EBS does borrow, will this choice affect the NPV of the expansion, and therefore change the value of the firm and its share price?

□ We explore these questions in this part of the course.

Financing and valuation

□ A firm's mix of sources of capital is referred to as its capital structure

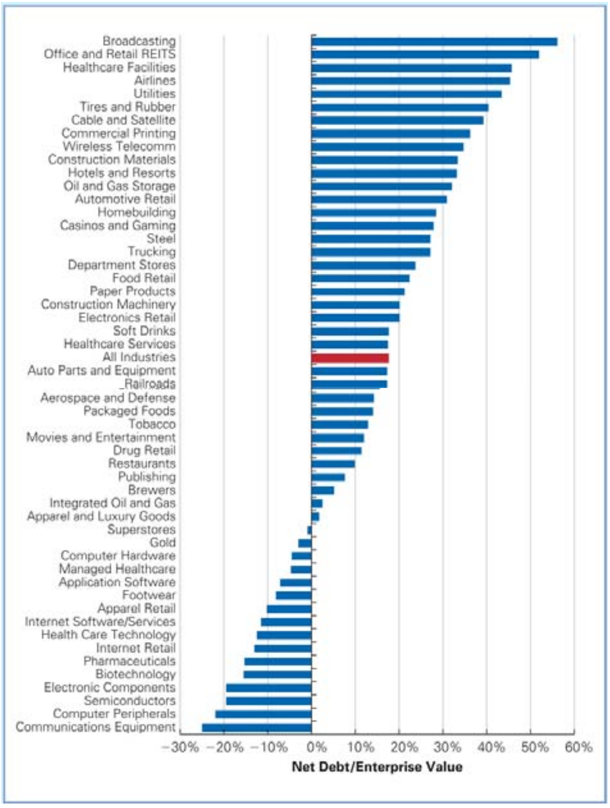
□ If a firm's capital structure includes a great deal of debt, then the firm is said to be highly leveraged

- A small percentage change in the firm's EBIT translates into a large percentage change in the firm's net income

Debt and leverage

- Large Swiss banks like UBS or Credit Suisse have very high debt ratios (i.e. 97% of their financing comes from debt)

- In general, do firms prefer debt ?
  - The use of net debt (debt minus cash) varies greatly by industry
  - Firms in growth industries like biotechnology or high technology carry very little debt, while airlines, automakers, utilities, and financial firms have high debt ratios



Modigliani/Miller Theorem

- If
  - There are **no taxes**
  - There are **no contracting costs** (costs of writing or enforcing contracts such as issuance costs, default costs, …)
  - The firm's **investment policy is fixed** (the firm invests in the same assets independently of its financing policy)
- Then

  Firm value is independent of financing policy

A Quick Lesson on Logic

If A then B

implies

If not B then not A

Modigliani/Miller II

□ If the choice of capital structure affects current firm value, then it does so by changing

- Tax liabilities
- Contracting costs
- Investment policy

Proof of the M/M Theorem

□ Assume there are no taxes, no contracting costs and the firm's investment policy is fixed

□ If two firms are identical except for their capital structures, an opportunity to earn arbitrage profits exists if the values of the two firms are not the same

□ **Example**: Two Firms

- Exist for one year
- Produce identical cash flow X (same investment policy)
- Then liquidate (could use infinite horizon or stochastic liquidation time; see handout 5)
- Are financed differently

Proof of the M/M Theorem

	Company U (unlevered)		Company L (levered)	
	Cash Flow	Current Value	Cash Flow	Current Value
Debt	0	0	$(1+r_D)D$	D
Equity	X	V^U	$X- (1+r_D)D$	E^L
Total	X	V^U	X	$V^L = D+E^L$

- These two firms yield the same future cash flows
- They must therefore have the same value by **the law of one price**

Proof of the M/M Theorem

- Suppose that

  $V^U = \$100$ *million* $> V^L = D + E^L = \$90$ *million*

  $D = \$30$ *million* and $E^L = \$60$ *million*

- Sell today 20% of shares of firm U

  $\Rightarrow$ yields $20 million

- Simultaneously buy 20% of L and 20% of its debt

  $\Rightarrow$ costs $18 million

- Profit = $20 Million -$18Million = $2 million

Proof of the M/M Theorem

□ **Tomorrow**

You pay dividends : - *0.2 X*

You receive dividends from L: + $0.2\,[X - (1+r_D)\,D]$

You receive payments from the bond: + $0.2\,[(1+r_D)]D$

□ **Total payoff tomorrow = 0**

□ By the law of one price, the total value of the two firms must be the same regardless of how they are financed

□ That is, in **perfect capital markets** neither firm value nor the expected return on assets ($\frac{X}{V^U} = \frac{X}{V^L}$) are affected by debt financing

Proof of the M/M Theorem

□ What are the frictions that we have ignored?

- Investment policy is fixed (same *X*)
- No taxes
- No cost of issuing debt or equity
- No cost of defaulting on the debt contract
- No cost when forming arbitrage portfolios

Implications for returns

□ If a firm is **unlevered**, all of the free cash flows generated by its assets are paid out to its equity holders

- The market value, risk, and cost of capital for the firm's assets and its equity coincide and, therefore

(Return on unlevered equity) $R_U = R_A$ *(Return on assets)*

□ If a firm is **levered**, the project value equals the sum of the values of debt and equity **at any point in time** and the project's return R_A is equal to the firm's weighted average cost of capital

- Unlevered cost of capital (pre-tax WACC)

$$\boxed{WACC = \frac{E}{E+D}R_E + \frac{D}{E+D}R_D = R_A = R_U}$$

Implications for returns

□ Let E and D denote the market values of equity and debt if the firm is **levered.** Let U be the market value of equity if the firm is **unlevered**. Let A be the market value of the firm's assets. The Modilgliani/Millet theorm implies

$$E + D = U = A$$

□ Thus by holding a portfolio of the firm's debt and equity we can replicate the cash flows from holding **unlevered** equity

□ Because the return of a portfolio equals a weighted average of the returns of the securities in it, we also have

$$\boxed{WACC = \frac{E}{E+D}R_E + \frac{D}{E+D}R_D = R_A = R_U}$$

Implications for returns

□ We have just shown that:

$$R_U = \frac{E}{E+D} R_E + \frac{D}{E+D} R_D$$

□ Solving for R_E yields

$$R_E = R_U + \frac{D}{E}(R_U - R_D)$$

□ While the weighted average cost of capital does not depend on the firm's debt in a frictionless world, this is not the case of the return on equity

Implications for betas

□ If a firm is unlevered, all of the free cash flows generated by its assets are paid out to its equity holders

- The beta and risk for the firm's assets (β_A) and its equity (β_U) coincide and, therefore

$$\beta_U = \beta_A$$

□ If a firm is levered, the firm's beta is equal to the weighted average of the beta of its equity (β_E) and the beta of its debt (β_D)

$$\frac{E}{E+D}\beta_E + \frac{D}{E+D}\beta_D = \beta_U = \beta_A$$

or

$$\beta_E = \beta_U + \frac{D}{E}(\beta_U - \beta_D)$$

Example

- You are considering an investment opportunity
  - For an initial investment of $800 this year, the project will generate cash flows of either $1400 or $900 next year, depending on whether the economy is strong or weak
  - Both scenarios are equally likely
  - The current risk-free interest rate is 5% and the project risk premium is 10%

Date 0	Date 1	
	Strong Economy	Weak Economy
−$800	$1400	$900

Example

- What is the NPV of this investment opportunity?

$$NPV = \frac{0{,}5 \times 1400 + 0{,}5 \times 900}{1{,}15} - 800 = 200$$

- If you finance this project using only equity, how much would you be willing to pay for the project

$$\frac{0{,}5 \times 1400 + 0{,}5 \times 900}{1{,}15} = \$1000$$

- **Unlevered Equity**
  - Equity in a firm with no debt
  - Because there is no debt, the cash flows of the unlevered equity are equal to those of the project

Example

□ What are the returns to shareholders?

	Date 0	Date 1: Cash Flows		Date 1: Returns	
	Initial Value	Strong Economy	Weak Economy	Strong Economy	Weak Economy
Unlevered equity	$1000	$1400	$900	40%	−10%

□ The expected return on unlevered equity is

$$E[R_U] = 0{,}5 \times 40\% + 0{,}5 \times (-10\%) = 15\%$$

□ Now suppose you decide to borrow $500 initially, in addition to selling equity

- Note that because the project's cash flow will always be enough to repay the debt, **the debt is risk free**

Example

□ **Levered equity**: Equity in a firm with debt

- Levered equity carries a higher risk premium than unlevered equity

□ Cash flows and returns to debt- and equity-holders

	Date 0	Date 1: Cash Flows	
	Initial Value	Strong Economy	Weak Economy
Debt	$500	$525	$525
Levered equity	E=?	$875	$375
Firm	$1,000	$1,400	$900

Example

□ Because the cash flows of the debt and equity sum to the cash flows of the project, by the Law of One Price the combined values of debt and equity must be $1000

- *Equity value = 1000-500 = $500*

	Date 0	Date 1: Cash Flows		Date 1: Returns		
	Initial Value	Strong Economy	Weak Economy	Strong Economy	Weak Economy	Expected Return
Debt	$500	$525	$525	5%	5%	5%
Levered equity	$500	$875	$375	75%	−25%	25%
Unlevered equity	$1000	$1400	$900	40%	−10%	15%

□ The expected return on levered equity is

$$E[R_E] = 0{,}5 \times 75\% + 0{,}5 \times (-25\%) = 25\%$$

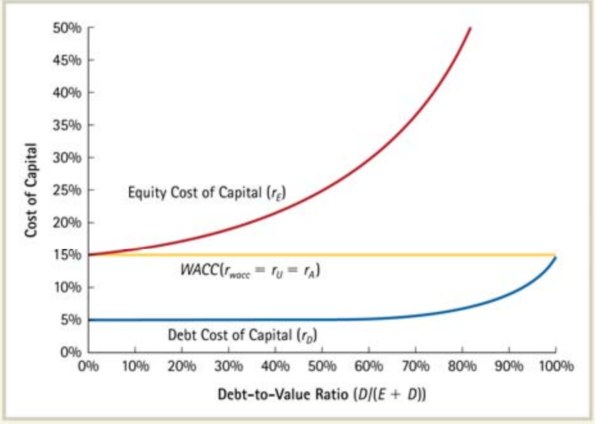
Example

□ The relationship between risk and return can be evaluated more formally by computing the sensitivity of each security's return to the systematic risk of the economy

	Return Sensitivity (Systematic Risk)	Risk Premium
	$\Delta R = R(\text{strong}) - R(\text{weak})$	$E[R] - r_f$
Debt	$5\% - 5\% = 0\%$	$5\% - 5\% = 0\%$
Unlevered equity	$40\% - (-10\%) = 50\%$	$15\% - 5\% = 10\%$
Levered equity	$75\% - (-25\%) = 100\%$	$25\% - 5\% = 20\%$

□ In this case, the levered equity has twice the systematic risk of the unlevered equity and, as a result, has twice the risk premium

□ Because the debt's return bears no systematic risk, its risk premium is zero (**Is it always the case that R_E exceeds R_D in a given firm?**)



(a) Equity, debt and weighted average costs of capital for different amounts of leverage. The rate of increase of r_D and r_E, and thus the shape of the curves, depends on the characteristics of the firm's cash flows.

E	D	r_E	r_D	$\frac{E}{E+D} r_E + \frac{D}{E+D} r_D$	$= r_{wacc}$
1000	0	15.0%	5.0%	1.0 × 15.0% + 0.0 × 5.0%	= 15%
800	200	17.5%	5.0%	0.8 × 17.5% + 0.2 × 5.0%	= 15%
500	500	25.0%	5.0%	0.5 × 25.0% + 0.5 × 5.0%	= 15%
100	900	75.0%	8.3%	0.1 × 75.0% + 0.9 × 8.3%	= 15%

(b) Calculating the WACC for alternative capital structures. Data in this table correspond to the example in Section 14.1.

Capital structure fallacies

Leverage can increase a firm's expected earnings per share. This is sometimes used (**incorrectly**) as an argument that leverage should also increase the firm's stock price

- **Example**
  - LVI is currently an all-equity firm.
  - It expects to generate earnings before interest and taxes (EBIT) of $10 million over the next year.
  - Currently, LVI has 10 million shares outstanding, and its stock is trading for a price of $10 per share.
  - LVI is considering changing its capital structure by borrowing $20 million at an interest rate of 6% and using the proceeds to repurchase 2 million shares at $10 per share

Capital structure fallacies

□ Suppose LVI has no debt. Since there is no interest and no taxes, LVI's earnings are equal its EBIT and LVI's earnings per share without leverage are

$$EPS = \frac{Earnings}{Number\ of\ shares} = \frac{\$10mo}{10mo} = \$1$$

□ If LVI recapitalizes, the new debt will obligate LVI to make interest payments each year of $1.2 million/year

$20 million × 6% = $1.2 million

□ As a result, LVI will have expected earnings after interest of

Earnings = EBIT – Interest = $8.8 million

Capital structure fallacies

□ Earnings per share rises to

$8.8 million ÷ $8 million shares = $1.1

□ **LVI's expected earnings per share increases with leverage**

□ Are shareholders better off?

NO! Although LVI's expected EPS rises with leverage, the risk of its EPS also increases. (Implications for bank regulation)

While EPS increases on average, this increase is necessary to compensate shareholders for the additional risk they are taking, so LVI's share price does not increase as a result of the transaction

Capital structure fallacies

- The required rate of return before the recapitalization is

- The required rate of return after the recapitalization is

- The share price after the recapitalization is

M/M: Theory and practice

- In a perfect capital market, a firm's choice of capital structure does not affect its value

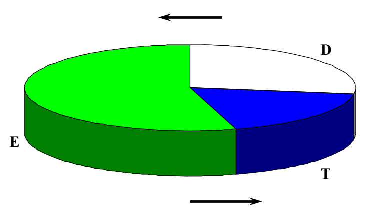
- This statement is at odds with the observation that firms invest significant resources in managing their capital structures

- Must be related to
  - Taxes
  - Contracting costs
  - Investment policy

Debt, taxes, and firm value

- Assume we represent the value of the firm's cash flows as a pie chart and the claims on these cash flows as slices of the pie
- There are three slices
  - Equity
  - Debt
  - The government
- The owner of the firm is interested in maximizing the debt and equity slices, which he can sell

Debt, taxes, and firm value



Interest payments to bondholders are deductible for tax purposes while payments to equity holders are not.

$$V^L = V^U + PV(\text{Interest Tax Shield})$$

Debt, taxes, and firm value

□ Consider Macy's which had earnings before interest and taxes of approximately $2.5 billion in 2011, and interest expenses of about $430 million. Macy's marginal corporate tax rate was 35%

□ As shown below, Macy's net income in 2011 was lower with leverage than it would have been without leverage

	With Leverage	Without Leverage
EBIT	$2500	$2500
Interest expense	−430	0
Income before tax	2070	2500
Taxes (35%)	−725	−875
Net income	$1345	$1625

Debt, taxes, and firm value

□ Macy's debt obligations reduced the value of its equity. But the total amount available to all investors was $150 higher with leverage

	With Leverage	Without Leverage
Interest paid to debt holders	430	0
Income available to equity holders	1345	1625
Total available to all investors	$1775	$1625

□ Where does the additional $150 million come from?

- The gain is equal to the reduction in taxes with leverage: $875 million − $725 million = $150 million. The interest payments provided a tax savings of

  35% × $430 million = $150 million

Debt, taxes, and firm value

□ When a firm uses debt, the interest tax shield provides a corporate tax benefit each year

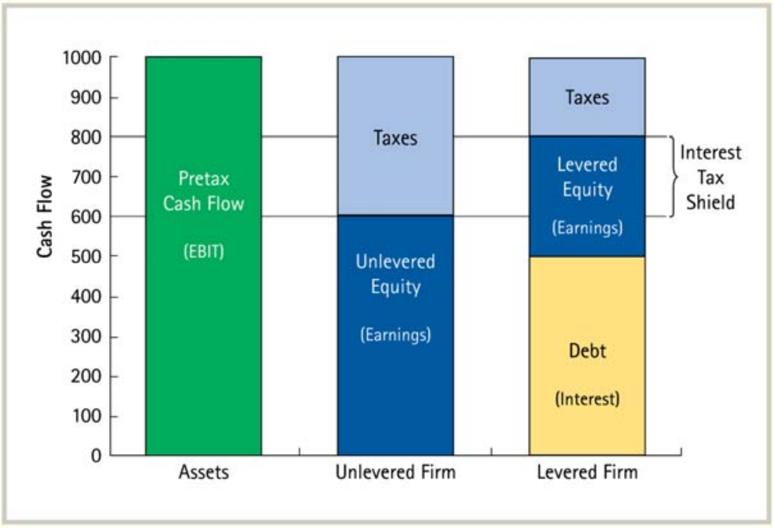
□ This benefit is computed as the present value of the stream of future interest tax shields the firm will receive

□ The cash flows a levered firm pays to investors will be higher than they would be without leverage by the amount of the interest tax shield

$$\left(\begin{array}{c}\text{Cash Flows to Investors}\\ \text{with Leverage}\end{array}\right) = \left(\begin{array}{c}\text{Cash Flows to Investors}\\ \text{without Leverage}\end{array}\right) + (\text{Interest Tax Shield})$$

Debt, taxes, and firm value

□ The increase in total cash flows paid to investors is the interest tax shield



Debt, taxes, and firm value

□ **Why are we interested in maximizing total firm value and not just the equity value?**

$V^U = 100$	$E = 100$	*Issue debt D = 40* *Save 10 in taxes* *Pay 40 in dividends* →	$V^L = 110$	$D = 40$ $E = 70$

□ **The wealth of shareholders is:**

$$\boxed{\textit{dividends} + E = 40 + 70 = 110}$$

Debt, taxes, and firm value

□ **Why are we interested in maximizing total firm value and not just the equity value?**

$V^U = 100$	$E = 100$	*Issue debt D = 40* *Save 10 in taxes* *No dividends* →	$V^L = 100 + 40 + 10$	$D = 40$ $E = 110$

□ **The wealth of shareholders is:**

$$\boxed{E = V^L - D = 150 - 40 = 110}$$

Debt, taxes, and firm value

- **Summary**:
  - When firms pay corporate taxes, issuing debt reduces taxes and increases firm value
  - If the NPV of debt at issuance is zero (i.e. if debt is fairly priced), debtholders do not get any of these benefits
  - In such instances, shareholders capture all the tax benefits of issuing debt. Therefore, the amount of debt that maximizes firm value also maximizes equity value

Taxes and firm value

- The tax deductibility of interest payments implies

$$\boxed{V^L = V^U + PV(Interest\ tax\ shield)}$$

Valuing the Interest Tax Shield Without Risk

Problem

Suppose DFB plans to pay $100 million in interest each year for the next 10 years, and then repay the principal of $2 billion in year 10. These payments are risk free, and DFB's marginal tax rate will remain 35% throughout this period. If the risk-free interest rate is 5%, by how much does the interest tax shield increase the value of DFB?

Taxes and the cost of capital

Solution

In this case, the interest tax shield is 35% × \$100 million = \$35 million each year for the next 10 years. Therefore, we can value it as a 10-year annuity. Because the tax savings are known and not risky, we can discount them at the 5% risk-free rate:

$$PV(\text{Interest Tax Shield}) = \$35 \text{ million} \times \frac{1}{5\%}\left(1 - \frac{1}{1.05^{10}}\right)$$
$$= \$270 \text{ million}$$

The final repayment of principal in year 10 is not deductible, so it does not contribute to the tax shield.

Taxes and the cost of capital

- One way to incorporate the tax benefits of debt is to use the APV or **Adjusted Present Value** Method
- To compute the **APV**, first calculate the base case NPV using the before-tax discount rate or required return on asset
- Then add the present value of any financing side effects

$$\boxed{\begin{aligned} APV = \;& NPV \\ & + \textit{Side effects of financing} \\ & (\textit{tax benefits in this case}) \end{aligned}}$$

- This approach will be preferred when ***the firm does not maintain a constant leverage ratio*** but repays debt according to some predetermined, fixed schedule

Recapitalization example using the APV

□ Assume that Midco Industries wants to boost its stock price

□ The company currently has 20 million shares outstanding with a market price of $15 per share and no debt

□ Midco has had consistently stable earnings, and pays a 35% tax rate. Management plans to borrow $100 million on a permanent basis and they will use the borrowed funds to repurchase outstanding shares

□ Without leverage

$$V^U = (20 \text{ million shares}) \times (\$15/\text{share}) = \$300 \text{ million}$$

□ With permanent debt

$$\begin{aligned} PV(\text{Interest Tax Shield}) &= PV(\tau_c \times \text{ Future Interest Payments}) \\ &= \tau_c \times PV(\text{Future Interest Payments}) \\ &= \tau_c \times D \end{aligned}$$

□ If Midco borrows $100 million using permanent debt, the present value of the firm's future tax saving is

$$\boxed{PV(\text{Interest tax shield}) = 35\% \times \$100 \text{ million} = \$35 \text{ million}}$$

□ Thus the total value of the levered firm will be

$$\boxed{V^L = V^U + \tau_c D = \$300 \text{ million} + \$35 \text{ million} = \$335 \text{ million}}$$

□ The value of debt is $100 million; the value of equity is

$$\boxed{E = V^L - D = \$335 \text{ million} - \$100 \text{ million} = \$235 \text{ million}}$$

Recapitalization example using the APV

□ Although the value of the shares outstanding drops to $235 million, shareholders will also receive the $100 million that Midco will pay out through the share repurchase

- **In total, shareholders will receive the full $335 million**

□ The value of the Midco's equity rises immediately from $300 million to $335 million after the repurchase announcement

□ With 20 million shares outstanding, the share price will rise to $16.75 per share

($335 million) ÷ (20 million shares) = $16.75/share

Recapitalization example using the APV

□ With a repurchase price of $16.75, the shareholders who tender their shares and the shareholders who hold their shares both gain $1.75 per share as a result of the transaction

$16.75 - $15 = $1.75/share

□ The benefit of the interest tax shield goes to all 20 million of the original shares outstanding for a total benefit of

($1.75/share) x (20 million shares) = $35 million

□ When securities are fairly priced, the original shareholders of a firm capture the full benefit of the interest tax shield

Recapitalization example using the APV

Market Value Balance Sheet ($ million)	Initial	Step 1: Recap Announced	Step 2: Debt Issuance	Step 3: Share Repurchase
Assets				
Cash	0	0	100	0
Original assets (V^U)	300	300	300	300
Interest tax shield	0	35	35	35
Total assets	300	335	435	335
Liabilities				
Debt	0	0	100	100
Equity = Assets − Liabilities	300	335	335	235
Shares outstanding (million)	20	20	20	14.03
Price per share	$15.00	$16.75	$16.75	$16.75

Taxes and firm value

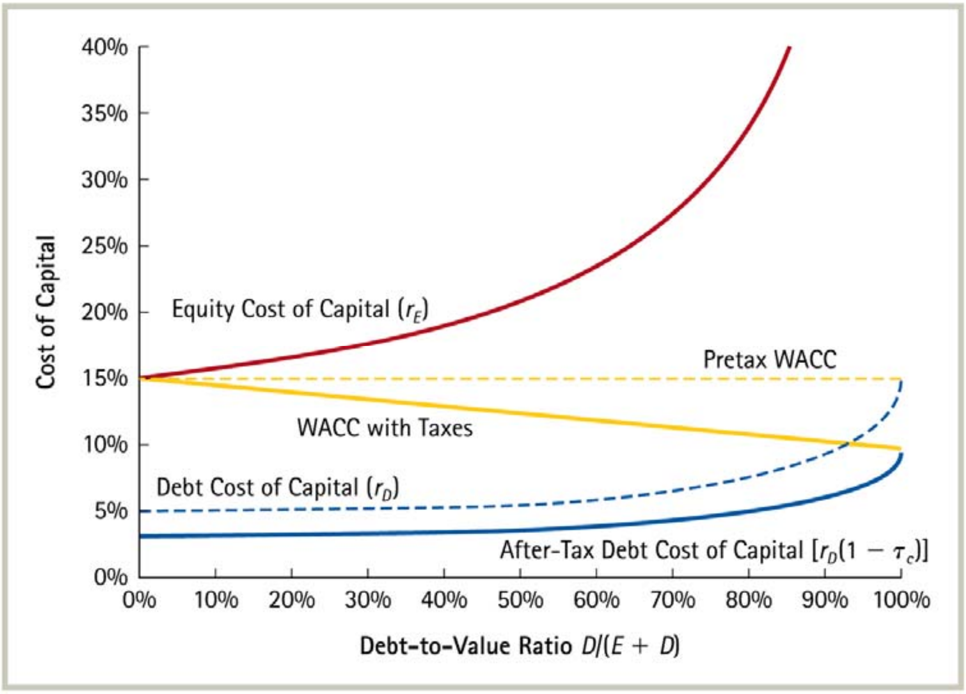
□ **Another way to take into account the tax benefits** of debt is through the WACC. *This is preferred when the firm maintains a constant leverage ratio*

□ Denote by τ_c the corporate tax rate. With tax-deductible interest, the effective after-tax borrowing rate is $R_D(1-\tau_c)$ and the weighted average cost of capital becomes

$$\boxed{r_{WACC} = \frac{E}{E+D}R_E + \frac{D}{E+D}(1-\tau_c)R_D}$$

□ The WACC decreases and firm value increases as the firm adds corporate debt in its capital structure. We also have

$$r_{WACC} = \underbrace{\frac{E}{E+D}R_E + \frac{D}{E+D}R_D}_{pre-tax\ WACC} - \underbrace{\frac{D}{E+D}R_D\tau_c}_{tax\ shield\ reduction}$$



Valuation with debt

- Debt provides tax benefits and increases firm value and shareholder wealth
- Several methods can be used to value firms/projects with debt
  - The WACC method
  - The APV method
  - The flow to equity (FTE) method
- In the following we implement these methods assuming
  - The project has average risk (i.e. same risk as existing assets)
  - The firm's debt-equity ratio is constant
  - Corporate taxes are the only imperfection

The WACC method

□ For now, it is assumed that the firm maintains a constant debt-equity ratio and that the WACC remains constant over time

□ The WACC is given by

$$r_{WACC} = \frac{E}{E+D} R_E + \frac{D}{E+D}(1-\tau_c) R_D$$

□ The value of the firm/project satisfies

$$V_0^L = \frac{FCF_1}{1+r_{WACC}} + \frac{FCF_2}{(1+r_{WACC})^2} + \frac{FCF_3}{(1+r_{WACC})^3} + \cdots$$

The WACC method

□ Avco is considering introducing a new line of packaging, the RFX Series

- Avco expects the technology used in these products to become obsolete after four years. The marketing group expects annual sales of $60 million per year over the next four years for this product line
- Manufacturing costs and operating expenses are expected to be $25 million and $9 million, respectively, per year
- Developing the product will require upfront R&D and marketing expenses of $6.67 million, together with a $24 million investment in equipment
- The equipment will be obsolete in four years and will be depreciated using the straight-line method over that period
- Avco expects no net working capital requirements
- Avco pays a corporate tax rate of 40%

The WACC method

□ Given the information above, we can forecast the project's expected free cash flows as follows:

	Year	0	1	2	3	4
Incremental Earnings Forecast ($ million)						
1	Sales	—	60.00	60.00	60.00	60.00
2	Cost of Goods Sold	—	(25.00)	(25.00)	(25.00)	(25.00)
3	**Gross Profit**	—	35.00	35.00	35.00	35.00
4	Operating Expenses	(6.67)	(9.00)	(9.00)	(9.00)	(9.00)
5	Depreciation	—	(6.00)	(6.00)	(6.00)	(6.00)
6	**EBIT**	(6.67)	20.00	20.00	20.00	20.00
7	Income Tax at 40%	2.67	(8.00)	(8.00)	(8.00)	(8.00)
8	**Unlevered Net Income**	(4.00)	12.00	12.00	12.00	12.00
Free Cash Flow						
9	Plus: Depreciation	—	6.00	6.00	6.00	6.00
10	Less: Capital Expenditures	(24.00)	—	—	—	—
11	Less: Increases in NWC	—	—	—	—	—
12	**Free Cash Flow**	**(28.00)**	**18.00**	**18.00**	**18.00**	**18.00**

The WACC method

□ The market risk of the RFX project is expected to be similar to that for the company's other lines of business

□ The table below shows AVCO's current market value balance sheet and equity and debt costs of capital

Assets		Liabilities		Cost of Capital	
Cash	20	Debt	320	Debt	6%
Existing Assets	600	Equity	300	Equity	10%
Total Assets	620	Total Liabilities and Equity	620		

Net debt versus gross debt

□ Many firms hold significant amounts of cash. In this case we can measure the leverage of the firm in terms of its net debt, defined as gross debt minus cash

□ The intuition for using net debt is that if the firm holds $1 in cash and $1 in debt, then the interest paid on the cash will equal the interest paid on the debt

□ AVCO has built up $20million in cash for investment needs, so its net debt is $D = 320 - 20 = \$300\ million$

□ AVCO's entreprise value is: $E + D = \$600\ million$

□ AVCO expects will maintain a similar (net) debt-equity ratio for the future, including any financing related to RFX

The WACC method

□ With this capital structure, AVCO's weighted average cost of capital is

$$r_{WACC} = \frac{300}{600}10\% + \frac{300}{600}(1 - 0{,}4)6\% = 6{,}8\%$$

□ The value of the project satisfies

$$V_0^L = \frac{18}{1{,}068} + \frac{18}{1{,}068^2} + \frac{18}{1{,}068^3} + \frac{18}{1{,}068^4} = \$61{,}25\ million$$

□ The NPV of the project is

$$61{,}25 - 28 = 33{,}25\ million$$

The WACC method

Valuing an Acquisition Using the WACC Method

Problem

Suppose Avco is considering the acquisition of another firm in its industry that specializes in custom packaging. The acquisition is expected to increase Avco's free cash flow by \$3.8 million the first year, and this contribution is expected to grow at a rate of 3% per year from then on. Avco has negotiated a purchase price of \$80 million. After the transaction, Avco will adjust its capital structure to maintain its current debt-equity ratio. If the acquisition has similar risk to the rest of Avco, what is the value of this deal?

The WACC method

Solution

The free cash flows of the acquisition can be valued as a growing perpetuity. Because its risk matches the risk for the rest of Avco, and because Avco will maintain the same debt-equity ratio going forward, we can discount these cash flows using the WACC of 6.8%. Thus, the value of the acquisition is

$$V^L = \frac{3.8}{6.8\% - 3\%} = \$100 \text{ million}$$

Given the purchase price of \$80 million, the acquisition has an NPV of \$20 million.

The WACC method

□ To summarize, the key steps in the WACC valuation method are as follows

- ‣ Determine the free cash flow of the investment
- ‣ Compute the weighted average cost of capital
- ‣ Compute the value of the investment, including the tax benefit of leverage, by discounting the free cash flow of the investment using the WACC

□ The WACC can be used throughout the firm as the companywide cost of capital for new investments that are of **comparable risk** to the rest of the firm and that **will not alter the firm's debt-equity ratio**

Implementing a constant debt-equity ratio

□ An advantage of the WACC method is that **you do not need to know how the constant debt-equity ratio is implemented**

□ By undertaking the RFX project, Avco adds new assets to the firm with initial market value $61.25 million

- ‣ To maintain its debt-to-value ratio, Avco must add $61,25 million x 50% = $30.625 million in new debt

□ Avco can add this debt either by reducing cash or by borrowing and increasing debt

- ‣ Assume Avco decides to spend its $20 million in cash and borrow an $10.625 million. Because only $28 million is required to fund the project, Avco will pay the remaining $2.625 million to shareholders through a dividend

Implementing a constant debt-equity ratio

□ The market value of Avco's equity increases by

$$330{,}625 - 300 = \$30{,}625\ million$$

□ Adding the dividend of \$2.625 million, the shareholders' total gain is \$33.25 million, which is exactly the NPV calculated for the RFX project

Assets		Liabilities	
Cash	—	Debt	330.625
Existing Assets	600.00		
RFX Project	61.25	Equity	330.625
Total Assets	661.25	Total Liabilities and Equity	661.25

Implementing a constant debt-equity ratio

□ Define the **debt capacity** as the amount of debt at a particular date that is required to maintain the firm's target debt-to-value ratio. It is calculated as

$$D_t = d \times V_t^L$$

□ In this equation d is the firm's target debt-to-value ratio and V_t^L is the project's levered continuation value given by

$$V_t^L = \frac{FCF_{t+1} + V_{t+1}^L}{1 + r_{WACC}}$$

□ This gives

	Year	0	1	2	3	4
Project Debt Capacity (\$ million)						
1	**Free Cash Flow**	(28.00)	18.00	18.00	18.00	18.00
2	Levered Value, V^L (at r_{wacc} = 6.8%)	61.25	47.41	32.63	16.85	—
3	**Debt Capacity, D_t (at d = 50%)**	**30.62**	**23.71**	**16.32**	**8.43**	**—**

The APV method

□ The APV method is an alternative method in which we find the value V^L of an investment by first calculating the unlevered value V^U and then adding the value of the interest tax shield:

$$V^L = APV = V^U + PV(Interest\ tax\ shield)$$

□ The first step in the APV method is thus to calculate the value of the free cash flows using the project's cost of capital if it were financed without debt

□ For a firm that maintains a target leverage ratio, this **unlevered cost of capital** can be estimated as the weighted average cost of capital computed without taking into account taxes

$$R_U = \frac{E}{E+D} R_E + \frac{D}{E+D} R_D = Pretax\ WACC$$

The APV method

□ We value the interest tax shield separately

□ The interest tax shield depends on the firm's debt policy and whether it has a target leverage ratio

- This is the case when a firm adjusts its debt proportionally to a project's value or its cash flows (where the proportion need not remain constant)
- A constant market debt-equity ratio is a special case
- When the firm maintains a target leverage ratio, its future interest tax shields have similar risk to the project's cash flows, so **they should be discounted at the project's unlevered cost of capital R_U**

The APV method

□ For Avco, its unlevered cost of capital is calculated as

$$R_U = 0{,}50 \times 10{,}0\% + 0{,}50 \times 6{,}0\% = 8{,}0\%$$

□ The project's value without leverage is

$$V_0^U = \frac{18}{1{,}08} + \frac{18}{1{,}08^2} + \frac{18}{1{,}08^3} + \frac{18}{1{,}08^4} = \$59{,}62\ million$$

□ The value of \$59.62 million is the value of the unlevered project and does not include the value of the tax shield provided by the interest payments on debt

The APV method

□ To compute the PV of the interest tax shield, we first compute the interest payments

Year		0	1	2	3	4
Interest Tax Shield ($ million)						
1	**Debt Capacity, D_t (at d = 50%)**	30.62	23.71	16.32	8.43	—
2	Interest Paid (at r_D = 6%)		1.84	1.42	0.98	0.51
3	**Interest Tax Shield (at τ_c = 40%)**		**0.73**	**0.57**	**0.39**	**0.20**

□ The next step is to find the present value of the interest tax shield by discounting these cash flows at the project's unlevered cost of capital

$$PV(tax\ sav.) = \frac{0{,}73}{1{,}08} + \frac{0{,}57}{1{,}08^2} + \frac{0{,}39}{1{,}08^3} + \frac{0{,}20}{1{,}08^4} = \$1{,}63\ million$$

□ We then have: $V_0^L = 59{,}62 + 1{,}63 = \$61{,}25$ million

The APV method

□ To summarize, the key steps in the APV valuation method

- Determine the investment's value without leverage
- Determine the present value of the interest tax shield

  a. Determine the interest tax shield. Given debt D_t on date t, the interest tax shield is $\tau_c R_D D_t$ on date $t+1$

  b. Discount the interest tax shield. If a constant debt-equity ratio is maintained using R_U is appropriate

- Add the unlevered value to the PV of the interest tax shield to determine the value of the investment with leverage

□ The APV method can be easier to apply than the WACC method when the firm does not maintain a constant debt-equity ratio

The APV method

Using the APV Method to Value an Acquisition

Problem

Consider again Avco's acquisition from Examples 18.1 and 18.2. The acquisition will contribute \$3.8 million in free cash flows the first year, which will grow by 3% per year thereafter. The acquisition cost of \$80 million will be financed with \$50 million in new debt initially. Compute the value of the acquisition using the APV method, assuming Avco will maintain a constant debt-equity ratio for the acquisition.

The APV method

Solution

First, we compute the value without leverage. Given Avco's unlevered cost of capital of $r_U = 8\%$, we get

$$V^U = 3.8/(8\% - 3\%) = \$76 \text{ million}$$

Avco will add new debt of \$50 million initially to fund the acquisition. At a 6% interest rate, the interest expense the first year is $6\% \times 50 = \$3$ million, which provides an interest tax shield of $40\% \times 3 = \$1.2$ million. Because the value of the acquisition is expected to grow by 3% per year, the amount of debt the acquisition supports—and, therefore, the interest tax shield—is expected to grow at the same rate. The present value of the interest tax shield is

$$PV(\text{interest tax shield}) = 1.2/(8\% - 3\%) = \$24 \text{ million}$$

The value of the acquisition with leverage is given by the APV:

$$V^L = V^U + PV(\text{interest tax shield}) = 76 + 24 = \$100 \text{ million}$$

This value is identical to the value computed in Example 18.1 and implies an NPV of $100 - 80 = \$20$ million for the acquisition. Without the benefit of the interest tax shield, the NPV would be $76 - 80 = -\$4$ million.

The Flow-to-Equity method

□ A valuation method that calculates the free cash flow available to equity holders taking into account all payments to and from debt holders

□ The cash flows to equity holders are then discounted using the equity cost of capital R_E

□ **Free Cash Flow to Equity** (FCFE):

- The free cash flow that remains after adjusting for interest payments, debt issuance, and debt repayments

The Flow-to-Equity method

- Determining the FCFE:

	Year	0	1	2	3	4
Incremental Earnings Forecast ($ million)						
1	Sales	—	60.00	60.00	60.00	60.00
2	Cost of Goods Sold	—	(25.00)	(25.00)	(25.00)	(25.00)
3	**Gross Profit**	—	35.00	35.00	35.00	35.00
4	Operating Expenses	(6.67)	(9.00)	(9.00)	(9.00)	(9.00)
5	Depreciation	—	(6.00)	(6.00)	(6.00)	(6.00)
6	**EBIT**	(6.67)	20.00	20.00	20.00	20.00
7	Interest Expense	—	(1.84)	(1.42)	(0.98)	(0.51)
8	**Pretax Income**	(6.67)	18.16	18.58	19.02	19.49
9	Income Tax at 40%	2.67	(7.27)	(7.43)	(7.61)	(7.80)
10	**Net Income**	(4.00)	10.90	11.15	11.41	11.70
Free Cash Flow to Equity						
11	Plus: Depreciation	—	6.00	6.00	6.00	6.00
12	Less: Capital Expenditures	(24.00)	—	—	—	—
13	Less: Increases in NWC	—	—	—	—	—
14	Plus: Net Borrowing	30.62	(6.92)	(7.39)	(7.89)	(8.43)
15	**Free Cash Flow to Equity**	**2.62**	**9.98**	**9.76**	**9.52**	**9.27**

The Flow-to-Equity method

- Note two changes in the calculation of the free cash flows
  - Interest expenses are deducted before taxes
  - The proceeds from the firm's net borrowing activity are added in. These proceeds are positive when the firm issues debt and are negative when the firm reduces its debt by repaying principal

$$\boxed{Net\ borrowing\ at\ date\ t = D_t - D_{t-1}}$$

- We thus have

$$FCFE = FCF - (1-\tau_c)R_D D_{t-1} + D_t - D_{t-1}$$

The Flow-to-Equity method

□ The FCFE are given by

Free Cash Flow to Equity ($ million)	Year	0	1	2	3	4
1	**Free Cash Flow**	(28.00)	18.00	18.00	18.00	18.00
2	After-tax Interest Expense	—	(1.10)	(0.85)	(0.59)	(0.30)
3	Net Borrowing	30.62	(6.92)	(7.39)	(7.89)	(8.43)
4	**Free Cash Flow to Equity**	**2.62**	**9.98**	**9.76**	**9.52**	**9.27**

□ Because the FCFE represent payments to equity holders, they should be discounted at the project's equity cost of capital

$$NPV(FCFE) = 2{,}62 + \frac{9{,}98}{1{,}10} + \frac{9{,}76}{1{,}10^2} + \frac{9{,}52}{1{,}10^3} + \frac{9{,}27}{1{,}10^4} = \$33{,}25\ million$$

□ The value of the project's FCFE represents the gain to shareholders from the project, and it is identical to the NPV computed using the WACC and APV methods

The Flow-to-Equity method

□ To summarize, the key steps in the flow to equity method

- Determine the free cash flow to equity of the investment
- Determine the equity cost of capital
- Compute the equity value by discounting the free cash flow to equity using the equity cost of capital

The Flow-to-Equity method

Using the FTE Method to Value an Acquisition

Problem

Consider again Avco's acquisition from Examples 18.1, 18.2, and 18.4. The acquisition will contribute \$3.8 million in free cash flows the first year, growing by 3% per year thereafter. The acquisition cost of \$80 million will be financed with \$50 million in new debt initially. What is the value of this acquisition using the FTE method?

The Flow-to-Equity method

Solution

Because the acquisition is being financed with \$50 million in new debt, the remaining \$30 million of the acquisition cost must come from equity:

$$FCFE_0 = -80 + 50 = -\$30 \text{ million}$$

In one year, the interest on the debt will be $6\% \times 50 = \$3$ million. Because Avco maintains a constant debt-equity ratio, the debt associated with the acquisition is also expected to grow at a 3% rate: $50 \times 1.03 = \$51.5$ million. Therefore, Avco will borrow an additional $51.5 - 50 = \$1.5$ million in one year.

$$FCFE_1 = +3.8 - (1 - 0.40) \times 3 + 1.5 = \$3.5 \text{ million}$$

After year 1, FCFE will also grow at a 3% rate. Using the cost of equity $r_E = 10\%$, we compute the NPV:

$$NPV(FCFE) = -30 + 3.5/(10\% - 3\%) = \$20 \text{ million}$$

This NPV matches the result we obtained with the WACC and APV methods.

APV with other debt policies

□ Up to this point, it has been assumed the firm wishes to maintain a constant debt-equity ratio

□ Two alternative leverage policies will now be examined

- Constant interest coverage
- Predetermined debt levels

APV with constant interest coverage

□ With a constant interest coverage, a firm keeps its interest payments equal to a target fraction of its free cash flows

□ If the target fraction is k, then

$$Interest\ in\ year\ t = k \times FCF_t$$

□ With a constant interest coverage policy, value of the interest tax shield is proportional to the project's unlevered value and

$$PV(tax\ sav.) = PV(\tau_c kFCF) = \tau_c kPV(FCF) = \tau_c kV^U$$

□ The value of the firm with leverage is then

$$V^L = V^U + \tau_c kV^U = (1 + \tau_c k)V^U$$

APV with constant interest coverage

Valuing an Acquisition with Target Interest Coverage

Problem

Consider again Avco's acquisition from Examples 18.1 and 18.2. The acquisition will contribute \$3.8 million in free cash flows the first year, growing by 3% per year thereafter. The acquisition cost of \$80 million will be financed with \$50 million in new debt initially. Compute the value of the acquisition using the APV method assuming Avco will maintain a constant interest coverage ratio for the acquisition.

Solution

Given Avco's unlevered cost of capital of $r_U = 8\%$, the acquisition has an unlevered value of

$$V^U = 3.8/(8\% - 3\%) = \$76 \text{ million}$$

With \$50 million in new debt and a 6% interest rate, the interest expense the first year is $6\% \times 50 = \$3$ million, or $k = \text{Interest}/FCF = 3/3.8 = 78.95\%$. Because Avco will maintain this interest coverage, we can use Eq. 18.14 to compute the levered value:

$$V^L = (1 + \tau_c k)V^U = [1 + 0.4\ (78.95\%)]\ 76 = \$100 \text{ million}$$

This value is identical to the value computed using the WACC method in Example 18.1, where we assumed a constant debt-equity ratio.

APV with predetermined debt levels

- Rather than set debt according to a target debt-equity ratio or interest coverage level, a firm may adjust its debt according to a fixed schedule that is known in advance
- Assume now that Avco plans to borrow \$30.62 million and then will reduce the debt on a fixed schedule: \$20 million after one year, to \$10 million after two years, and to \$0 after three years
- We can compute the interest tax shield as

	Year	0	1	2	3	4
Interest Tax Shield (\$ million)						
1	**Debt Capacity, D_t (fixed schedule)**	30.62	20.00	10.00	—	—
2	Interest Paid (at $r_D = 6\%$)		1.84	1.20	0.60	—
3	**Interest Tax Shield (at $\tau_c = 40\%$)**		**0.73**	**0.48**	**0.24**	**—**

APV with predetermined debt levels

□ When debt levels are set according to a fixed schedule, we can **discount the predetermined interest tax shields using the debt cost of capital R_D**

□ We have

$$PV(tax\ sav.) = \frac{0{,}73}{1{,}06} + \frac{0{,}48}{1{,}06^2} + \frac{0{,}24}{1{,}06^3} = \$1{,}32 million$$

□ The levered value of Avco's project is

$$V^L = V^U + PV(Int.tax\ shield) = 59{,}62 + 1{,}32 = \$60{,}94 \text{ million}$$

□ When a firm has permanent fixed debt: $V^L = V^U + \tau_c D$

Leverage and the cost of capital

□ Suppose an investor holds a portfolio of all the equity and debt of the firm. Then the investor receives the free cash flows of the firm plus the tax savings from the interest tax shield

□ These are the same cash flows an investor would receive from a portfolio of the unlevered firm and a "tax shield" security that paid the investor the amount of the tax shield each period

□ By the Law of One Price the portfolios have the same values

$$V^L = E + D = V^U + T$$

where T is the present value of the interest tax shield. They also have the same cash flows and returns

$$ER_E + DR_D = V^U R_U + TR_T$$

Target leverage ratio and the cost of capital

□ Suppose the firm adjusts its debt to maintain a target debt-to-equity ratio, or a target ratio of interest to free cash flows

□ Because the firm's debt and interest payments will vary with the firm's value and cash flows, **the risk of the interest tax shield will equal that of the firm's free cash flows**, so $R_T = R_U$

□ In this case, $ER_E + DR_D = V^U R_U + TR_U = (E + D)R_U$ and the unlevered cost of capital satisfies

$$R_U = \frac{E}{E+D} R_E + \frac{D}{E+D} R_D$$

□ We can find the cost of equity as

$$R_E = R_U + \frac{D}{E}(R_U - R_D)$$

Predetermined debt schedule and the cost of capital

□ Suppose some of the firm's debt is set according to a pre-determined schedule that is independent of the firm growth

□ Suppose the value of the tax shield from the scheduled debt is T^S, and the remaining value of the tax shield $T - T^S$ is from the debt that will be adjusted according to a target leverage ratio

□ Because the risk of the interest tax shield is similar to the risk of the debt itself, we have

$$ER_E + DR_D = V^U R_U + (T - T^S)R_U + T^S R_D$$

□ Subtracting $T^S R_D$ from both sides, and using $D^S = \mathrm{D} - T^S$ yields

$$R_U = \frac{E}{E+D^S} R_E + \frac{D^S}{E+D^S} R_D$$

Predetermined debt schedule and the cost of capital

- This implies

$$R_E = R_U + \frac{D^S}{E}(R_U - R_D)$$

- We can combine this equation with that for the WACC to get

$$r_{WACC} = R_U - \frac{D}{D+E}\tau_C[R_D + \phi(R_U - R_D)]$$

- In this equation $\phi = \frac{T^S}{\tau_C D}$ is a measure of the permanence of the debt level D. With:
  - Continuously adjusted debt: $T^S = 0, D^S = D, and\ \phi = 0$
  - Permanent debt: $T^S = \tau_C D, D^S = D(1-\tau_C), and\ \phi = 1$

APV and WACC with Permanent Debt

Problem

International Paper Company is considering the acquisition of additional forestland in the southeastern United States. The wood harvested from the land will generate free cash flows of \$4.5 million per year, with an unlevered cost of capital of 7%. As a result of this acquisition, International Paper will permanently increase its debt by \$30 million. If International Paper's tax rate is 35%, what is the value of this acquisition using the APV method? Verify this result using the WACC method.

Solution

Using the APV method, the unlevered value of the land is $V^U = FCF/r_U = 4.5/0.07 = \$64.29$ million. Because the debt is permanent, the value of the tax shield is $\tau_c D = 0.35(30) = 10.50$. Therefore, $V^L = 64.29 + 10.50 = \$74.79$ million.

To use the WACC method, we apply Eq. 18.21 with $\phi = T^s/(\tau_c D) = 1$ and $d = 30/74.79 = 40.1\%$. Therefore, the WACC for the investment is

$$r_{wacc} = r_U - d\tau_c r_U = 7\% - 0.401 \times 0.35 \times 7\% = 6.017\%$$

and $V^L = 4.5/0.06017 = \$74.79$ million.

Comparison of methods

□ Typically, the **WACC method** is the easiest to use when the firm will maintain a fixed debt-to-value ratio over the life of the investment

- **Advantage**: One does not need to compute the project's debt capacity to determine the interest and net borrowing before capital budgeting decisions can be made

□ For alternative leverage policies, the APV method is usually the simplest approach

□ The FTE method is typically used only in complicated settings where the values in the firm's capital structure or the interest tax shield are difficult to determine

Project-based cost of capital

□ In the real world, a specific project may have different market risk than the average project for the firm

□ In addition, different projects may vary in the amount of leverage they will support

□ Suppose Avco launches a new plastics manufacturing division that faces different market risks than its main packaging business

- The unlevered cost of capital for the plastics division can be estimated by looking at other single-division plastics firms that have similar business risks

Project-based cost of capital

□ Assume two firms are comparable to the plastics division and have the following characteristics

Firm	Equity Cost of Capital	Debt Cost of Capital	Debt-to-Value Ratio, $D/(E+D)$
Comparable #1	12.0%	6.0%	40%
Comparable #2	10.7%	5.5%	25%

□ Assuming that both firms maintain a target leverage ratio, the unlevered cost of capital for each competitor can be estimated by calculating their pretax WACC

$$Comp\#1: R_U = 0{,}60 \times 12{,}0\% + 0{,}40 \times 6{,}0\% = 9{,}6\%$$

$$Comp\#2: R_U = 0{,}75 \times 10{,}7\% + 0{,}25 \times 6{,}0\% = 9{,}4\%$$

Project-based cost of capital

□ Based on these comparable firms, we estimate an unlevered cost of capital for the plastics division is approximately 9.5%

□ With this rate in hand we can use APV approach

□ To use WACC method, the division's WACC can be estimated as

$$r_{WACC} = R_U - \frac{D}{D+E}\tau_C R_D = 9{,}5\% - 0{,}5 \times 0{,}4 \times 6\% = 8{,}3\%$$

Costs of debt

- We have seen how to incorporate the tax benefits of debt into valuations
- Financing decisions may also affect valuations because of their effects on the costs of issuing securities or on default costs
- These costs are often ignored
  - For firms without very high levels of debt, the interest tax shield is likely to be the most important market imperfection affecting the valuation or capital budgeting decision
  - The costs of issuing debt are generally small and firms rarely issue equity

Default Costs

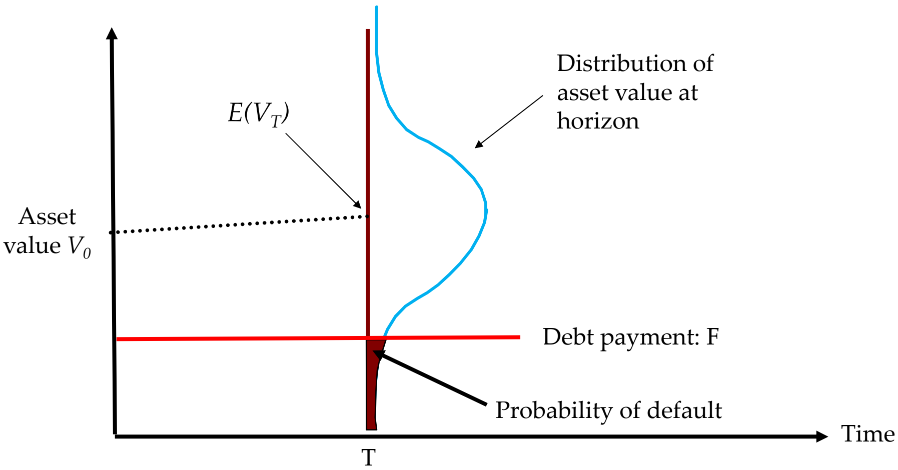
- The **expected default cost** is a function of two variables:
  - The cost of default (when the firm actually defaults)
  - The probability of default, which depends on the volatility of future cash flows and on the firm's leverage
- If you borrow more, you increase the probability of default and hence expected default costs
- Default costs include **direct** and **indirect** costs
  - **Examples of direct costs:** At the time Enron entered bankruptcy, it spent $30 million per month on legal and accounting fees. The total ultimately exceeded $750 million

Default Costs

- **Indirect costs of financial distress include**
  - Loss of costumers
  - Loss of suppliers (*Swiss Air* was forced to shut down because its suppliers refused to fuel its planes)
  - Loss of employees
  - Loss of receivables
  - Fire sales of assets (financial crisis of 2007-2009)
  - Delayed liquidation (Eastern Airlines lost 50% of its value while in bankruptcy)

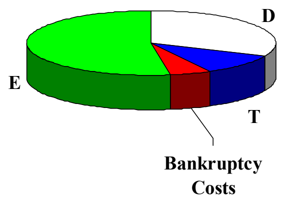
Default Costs

- What factors drive the probability of default? $\frac{V_0}{F}$, μ (or r), and σ



Asset value dynamics: $V_{t+\Delta t} = (1 + \mu\Delta t)V_t + \sigma V_t \varepsilon\sqrt{\Delta t}$ with $\varepsilon \sim N(0,1)$

Taxes and Default Costs



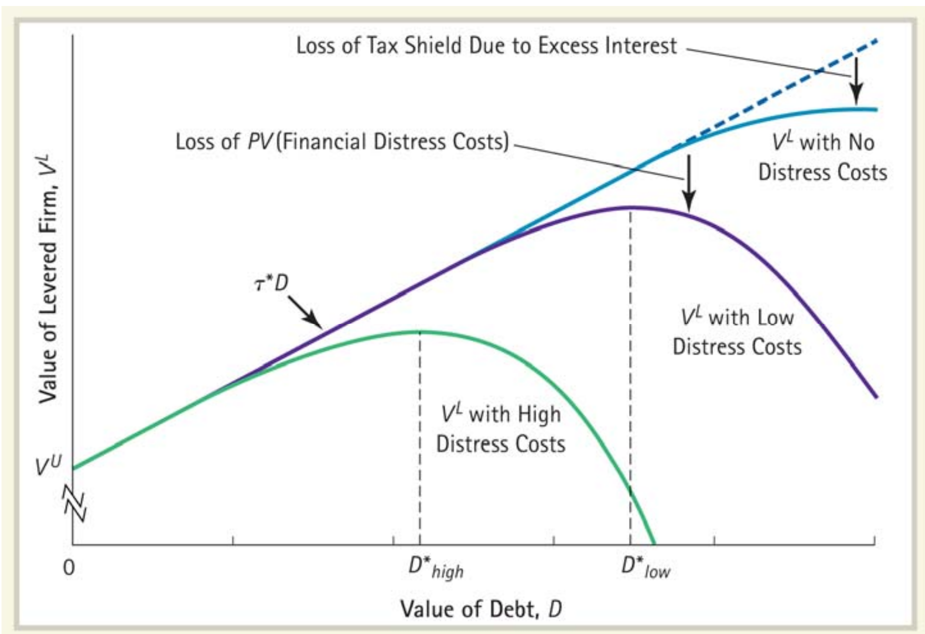
V(Levered firm) = *V(Unlevered firm)*

\+ *PV (Tax shields)*

\- *PV (default costs)*

□ The value-maximizing capital structure balances the tax benefit of debt with the expected costs of default

Taxes and Default Costs



Default Costs

- Armin is considering a new project
- While the new product represents a significant advance over Armin's competitors' products, its success is uncertain
  - If it is a hit, revenues and profits will grow, and Armin will be worth $150 million at the end of the year
  - If it fails, Armin will be worth only $80 million
  - The project cash flows are unrelated to the state of the economy, so the project has a beta of 0 and the discount rate is the risk-free rate
  - Armin estimates that the likelihood of success is 80%

Default Costs

- Armin may employ one of two alternative capital structures
  - It can use all-equity financing
  - It can use debt that matures at the end of the year with a total of $100 million due

Default Costs

□ With debt of $100 million, Armin will be forced into default if the new product fails

‣ In this case, some of the value of Armin's assets will be lost to bankruptcy and financial distress costs

‣ Assume debt holders receive only $60 million after accounting for the costs of financial distress. The difference of $20 million is due to default costs

	Without Leverage		With Leverage	
	Success	Failure	Success	Failure
Debt value	—	—	100	60
Equity value	150	80	50	0
Total to all investors	150	80	150	60

Default Costs

□ The value of the unlevered firm is

$$V^U = \frac{0{,}8 \times 150 + 0{,}2 \times 80}{1{,}05} = 129{,}52$$

□ The values of debt and equity in the levered firm are

$$D = \frac{0{,}8 \times 100 + 0{,}2 \times 60}{1{,}05} = 87{,}62$$

and

$$E = \frac{0{,}8 \times 50 + 0{,}2 \times 0}{1{,}05} = 38{,}09$$

□ The value of the levered firm is

$$V^L = E + D = 38{,}09 + 87{,}62 = 125{,}71 < V^U$$

Default Costs

□ The value of debt without default costs is

$$D = \frac{0{,}8 \times 100 + 0{,}2 \times 80}{1{,}05} = 91{,}43$$

□ The difference between this value and the one with bankruptcy costs is the PV of default costs

$$\text{PV default costs} = \frac{0{,}8 \times 0 + 0{,}2 \times 20}{1{,}05} = 3{,}81$$

□ This is the amount by which firm value is reduced. **It is reflected in the increase in the yield on corporate debt**, which reduces the value of debt or, equivalently, *how much money the firm can raise by issuing debt*

Default Costs

□ *With default costs*, the yield on corporate debt R_D solves

$$D = 87{,}62 = \frac{100}{1 + R_D} \rightarrow R_D = 14{,}13\%$$

□ *Without default costs*, the yield on corporate debt R_D solves

$$D = 91{,}43 = \frac{100}{1 + R_D} \rightarrow R_D = 9{,}38\%$$

□ The **yield on corporate debt increases as the probability of default increases and as default costs increase**

□ When the project is sure to succeed, the probability of default is zero and the yield equals the risk free rate (i.e. R_D=5%)

Valuing Default Costs

Valuing Distress Costs

Problem

Your firm has zero coupon debt with a face value of $100 million due in 5 years time, and no other debt outstanding. The current risk-free rate is 5%, but due to default risk the yield to maturity of the debt is 12%. You believe that in the event of default, 10% of the losses are attributable to bankruptcy and distress costs. (For example, if the debt holders lose $60 million and recover $40 million, $6 million of the loss in value would not have occurred if the firm had been unlevered and thus avoided bankruptcy.) Estimate the present value of the distress costs.

Solution

With a 12% yield, the current market value of the firm's debt is $\$100/1.12^5 = \$56.74$ million. If the firm's debt were risk-free, its market value would be $\$100/1.05^5 = \$78.35$ million. The difference in these values, $\$78.35 - \$56.74 = \$21.61$ million, is the present value of the debt holders' expected losses in default. If 10% of these losses is due to bankruptcy and distress costs, then the present value of these costs is $\$21.61 \times 0.10 = \$2.16$ million.

Costs of issuing securities

□ When a firm raises capital by issuing securities, the banks that provide the loan or underwrite the sale of the securities charge fees

□ These fees should be included as part of the project's required investment, reducing the NPV of the project

Financing Type	Underwriting Fees
Bank loans	< 2%
Corporate bonds	
Investment grade	1–2%
Non-investment grade	2–3%
Equity issues	
Initial public offering	8–9%
Seasoned equity offering	5–6%

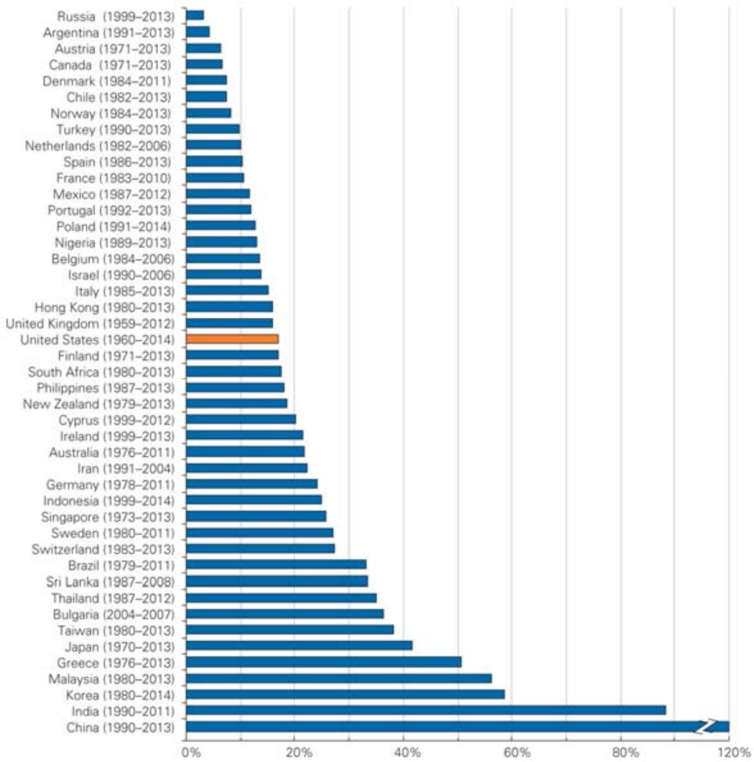
Costs of IPOs

- **Initial Public Offering (IPO)**: The process of selling stock to the public for the first time
- Costs of IPOs:
  - Disclosure of proprietary information
  - Agency costs of outside equity (shirking/incentive effects)
  - Costs of reporting/filing
  - Costs of corporate control; e.g. Hugh Hefner, the majority stockholder of Playboy was sued for having too many perquisites by outside minority shareholders
  - Underpricing: The average abnormal return in the first month after the IPO is greater than 10%

Costs of IPOs

- Top first day returns since 2001

Company Name	IPO Date	IPO Price	Return
Baidu.com	08/04/05	$27.00	353.9%
Dicerna Pharmaceuticals	01/29/14	$15.00	206.7%
Youku.com	12/07/10	$12.80	161.3%
Castlight Health	03/13/14	$16.00	148.8%
Qihoo 360 Technology	03/29/11	$14.50	134.5%
NYMEX	11/16/06	$59.00	125.4%
Sprouts Farmers Market	07/31/13	$18.00	122.8%
voxeljet	10/17/13	$13.00	121.5%
Potbelly	10/03/13	$14.00	119.8%
LinkedIn	05/18/11	$45.00	109.4%



Disney Valuation

- Model
  - Free cash flow valuation
  - Growth pattern: 3-stage model

Disney Valuation

	High growth phase	Transition phase	Stable growth phase
Length	5 years	5 years	Forever after 10 years
Revenues	Current: $22'571; Expected to grow at same rate as operating earnings	Grow at a lower rate than EBIT	Grows at stable growth rate
Pre-tax op. margin	26.67% of revenues based upon current EBIT of $6'020	Gradual Increase to 32% of revenues due to scale econ.	Stable margin is assumed to be 32%
Tax rate	36%	36%	36%
ROIC	20% (≈ current level)	Declines linearly to 16%	Stable ROIC of 16%
WC	5% of revenues	5% of revenues	5% of revenues
Reinvest Rate (Capex+work capital invest)/EBIT	50% of after tax op. income; Depreciation is $1'134 and grows at same rate as EBIT	Declines to 31.25% as ROIC and growth rates drop ; Reinvestment rate = g/ROIC	31.25% of after tax operating profit
Growth rate in EBIT	ROIC*Reinvestment Rate = 20% x 50% = 10%	Linear decline to stable growth rate	5% based upon overall nominal econ. Growth
D/(D+E)	18%	18%	18%

Disney Valuation

	Base	1	2	3	4	5	6	7	8	9	10
Exp. growth		10%	10%	10%	10%	10%	9%	8%	7%	6%	5%
Revenues	22571	24828	27311	30042	33046	36350	38105	39630	40891	41850	42475
Op. margin	26.67	26.67	26.67	26.67	26.67	26.67	27.73	28.80	29.86	30.93	32.00
EBIT	6020	6622	7283	8012	8814	9695	10567	11412	12212	12945	13592
EBIT(1-t)	3852	4238	4661	5128	5641	6205	6763	7304	7815	8284	8699
Depreciat.	1134	1247	1372	1509	1660	1826	1990	2150	2300	2438	2560
Cap. Expen.	2958	3254	3578	3936	4331	4763	5073	5250	5348	5348	5247
Δ in WC	102	112	124	137	150	165	88	76	63	48	31
FCF	1926	2119	2331	2564	2820	3103	3591	4127	4705	5327	5980
ROIC	20%	20%	20%	20%	20%	20%	19.2%	18.4%	17.6%	16.8%	16%
Reinv. Rate		50%	50%	50%	50%	50%	46.9%	43.5%	39.8%	35.7%	31.25%

The cost of capital

□ Because the firm maintains a constant debt-equity ratio, we should use the WACC method

□ To compute the WACC

- Estimate the percentages of debt and equity financing, based on the market values of equity and debt. Often the book value and the market value of debt are similar, unless the company is in distress
- Estimate the cost of equity (R_E) and the cost of debt (R_D). They must reflect the capital structure of the company
- Estimate the WACC using the appropriate capital structure, which represents the target mix of capital for the company

The cost of equity

□ We use the CAPM to compute the appropriate discount rate

□ The standard procedure for estimating betas is to regress excess stock returns (R_i - r_f) against the market risk premium

$$R_i - r_f = \alpha_i + \beta_i (R_{Mkt} - r_f) + \varepsilon_i$$

□ Estimation for Disney using monthly data over 5 years

$$Returns_{Disney} - r_f = 0.065\% + 1.25\ (Returns_{S\&P500} - r_f) \quad (R^2=32.41\%)$$

□ The estimated beta is 1.25. **This is a levered equity beta**.

□ 32% of the risk at Disney comes from market sources

□ The intercept is 0.065% which implies that Disney did 0.065% better that expected per month

Top-down vs bottom-up

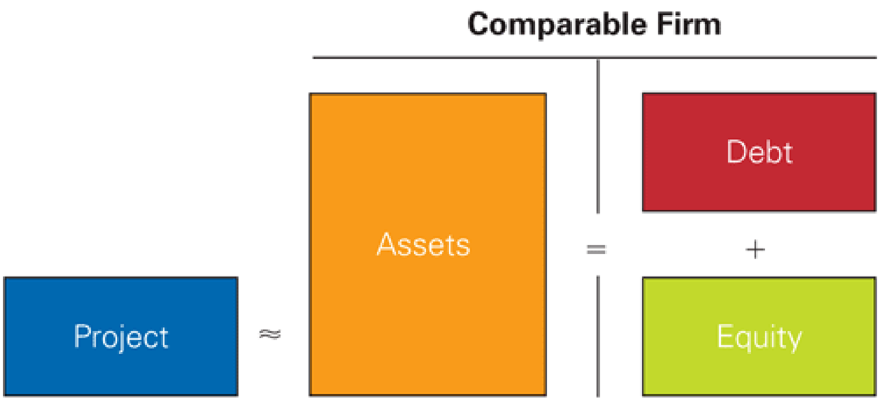
- The top-down beta for a firm comes from a regression (do not forget to adjust for the firm's financing policy)

- The bottom-up beta can be estimated by doing the following
  - Find out the business that a firm operates in
  - Find the unlevered betas of other firms in these businesses
  - Take a weighted average of these unlevered betas
  - Lever up using the firm's debt equity ratio

- Bottom up beta gives a better estimate when the standard error of the beta from the regression is high or if the firm has restructured itself substantially during the period of regression

Top-down vs bottom-up

- The bottom-up beta



- Combining estimates of asset betas for multiple firms in the same industry reduces the estimation error of the beta for the project

Top-down vs bottom-up

Estimating an Industry Asset Beta

Problem

Consider the following data for U.S. department stores in mid-2009, showing the equity beta, ratio of net debt to enterprise value (D/V), and debt rating for each firm. Estimate the average and median asset beta for the industry.

Company	Ticker	Equity Beta	D/V	Debt Rating
Dillard's	DDS	2.38	0.59	B
J. C. Penney Company	JCP	1.60	0.17	BB
Kohl's	KSS	1.37	0.08	BBB
Macy's	M	2.16	0.62	BB
Nordstrom	JWN	1.94	0.35	BBB
Saks	SKS	1.85	0.50	CCC
Sears Holdings	SHLD	1.36	0.23	BB

Top-down vs bottom-up

- Assume that the tax rate is τ_c=36%
- We have

By Rating	*A and above*	*BBB*	*BB*	*B*	*CCC*
Avg. Beta	< 0.05	0.10	0.17	0.26	0.31
By Maturity	(BBB and above)	*1–5 Year*	*5–10 Year*	*10–15 Year*	> 15 *Year*
Avg. Beta		0.01	0.06	0.07	0.14

Source: S. Schaefer and I. Strebulaev, "Risk in Capital Structure Arbitrage," Stanford GSB working paper, 2009.

*Note that these are average debt betas across industries. We would expect debt betas to be lower (higher) for industries that are less (more) exposed to market risk. One simple way to approximate this difference is to scale the debt betas in Table 12.3 by the relative asset beta for the industry (see Figure 12.4 on page 425).

Top-down vs bottom-up

□ Assuming comparable firms maintain a target capital structure, we have

$$E\beta_E + D\beta_D = (V_U + T)\beta_U$$

where T is the value of the tax shield and $\beta_T = \beta_U$

□ Since $E + D = V_U + T$, we can simplify this equation to get

$$\frac{E}{E+D}\beta_E + \frac{D}{E+D}\beta_D = \beta_U$$

This leads to the levering equation

$$\beta_E = \beta_U + \frac{D}{E}(\beta_U - \beta_D)$$

Top-down vs bottom-up

□ Assuming a constant debt-equity ratio and the formula

$$\frac{E}{E+D}\beta_E + \frac{D}{E+D}\beta_D = \beta_U$$

Ticker	Equity beta	$\frac{D}{E+D}$	Debt rating	Debt beta	Asset beta
DDS	2.38	0,59	B	0.26	1.13
JCP	1.60	0,17	BB	0.17	1.36
KSS	1.37	0,08	BBB	0.10	1.29
M	2.16	0,62	BB	0.17	0.93
JWN	1.94	0,35	BBB	0.10	1.30
SKS	1.85	0,50	CCC	0.31	1.08
SHLD	1.36	0,23	BB	0.17	1.09
				Average	**1.16**

Top-down vs bottom-up

□ Assuming comparable firms **do not** maintain a target capital structure, we have

$$E\beta_E + (D - T)\beta_D = (V - T)\beta_U$$

where T is the value of the tax shield and $\beta_D = \beta_T$

□ If debt is perpetual, $T = \tau_C D$ and we can simplify the above equation to get

$$\beta_U = \frac{\beta_E + \beta_D \frac{D}{E}(1 - \tau_C)}{1 + \frac{D}{E}(1 - \tau_C)}$$

□ We do not use this equation here as we assume a target leverage policy

Top-down vs bottom-up

□ Differences in project risk

- Firm asset betas reflect market risk of the average project in a firm
- In the real world, a specific project may have different market risk than the average project for the firm
- Financial managers in multi-divisional firms should evaluate projects based on asset betas of firms in a similar line of business

The cost of capital

- Estimate the cost of equity at different levels of debt

  The cost of equity should be **project specific**

  As the firm issues more debt, equity becomes riskier
  → Beta will increase → Cost of equity will increase

- Estimate the cost of debt

  As the firm issues more debt, default risk goes up
  → Cost of debt will increase

- Estimate the cost of capital at different debt levels using **market value weights** for debt and equity

- Calculate the effect on firm value and stock prices

Cost of capital: Disney, Current

- Equity:

  $$E(R_E) = r_f + \beta_E\,[E(R_M) - r_f] = 3.6\% + 1.25\ (6.0\%) = 11.10\%$$

- Debt: Suppose the cost of debt for Disney is 5.25%

  $$After\ tax\ cost = R_D\,(1-\tau_c) = 5.25\% \times 0.64 = 3.36\%$$

- Debt / (Debt + Equity) = 18%

- Cost of capital

  $$\boxed{WACC = 11.10\%\ (0.82) + 3.36\%\ (0.18) = 9.71\%}$$

Disney Valuation

□ The terminal value at the end of year 10 is estimated based upon the free cash flow to the firm in year 11 and the cost of capital in year 11

$FCF_{11} = FCF_{10}\,(1.05) = 5'980(1.05) = 6'279$

□ With a cost of capital in terminal year of 9.71%, the terminal value is given by

$$\Rightarrow Terminal\ value = \frac{6279}{0{,}0971 - 0{,}05} = 133'312$$

Disney Valuation

□ Discounting yields:

Year	1	2	3	4	5	6	7	8	9	10
FCF	2'119	2'331	2'564	2'820	3'103	3'591	4'127	4'705	5'327	5'980
TV										133'312
PV	1'931	1'936	1'941	1'947	1'952	2'059	2'157	2'242	2'313	55'140

□ Final valuation

- Value of the firm: $73'619 million
- Value of the debt: $13'251 million
- Value of the equity: $60'368 million
- Shave value: $\frac{Equity\ value}{Number\ of\ shares} = \frac{60'368}{675{,}13} = \$89{,}42$