APV FTE and WACC Approaches 1.pdf

APV FTE and WACC Approaches 2.pdf

APV FTE and WACC Approaches 3.pdf

Lecture 1.pdf

Lecture 10.pdf

Lecture 11.pdf

Lecture 12.pdf

Lecture 13.pdf

Lecture 14.pdf

Lecture 15.pdf

Lecture 16.pdf

Lecture 2.pdf

Lecture 3.pdf

Lecture 4.pdf

Lecture 5.pdf

Lecture 6.pdf

Lecture 7.pdf

Lecture 8.pdf

Lecture 9.pdf

Weighted Average Cost of Capital

And equivalent approaches

Review item

- A corporation is near bankruptcy. Why do the managers invest in bad risks?

Answer on bad risks

- Managers represent equity …
  at least they are supposed to.
- Risk gives them a chance to pull out of bankruptcy. Equity gets the gain.
- A bad outcome leaves them still bankrupt. Debt suffers the loss.

Capital Budgeting for the Levered Firm

- Adjusted Present Value
- Flows to Equity
- Weighted Average Cost of Capital
- APV Example

Adjusted-Present-Value (APV)

- NPV for an unlevered firm
- NPVF = net present value of financing
- APV = NPV + NPVF

Unlevered NPV

- Unlevered cash flows = CF from operations - Capital Spending - Added NWC - corporate taxes for unlevered firm.
- Discount rate: r_0
- PV_{UCF}: PV of unlevered cash flows
- $NPV = PV_{UCF}$ - Initial investment

Net present value of financing side effects

- PV of Tax Subsidy to Debt
- Costs of Issuing New Securities
- The Costs of Financial Distress
- Subsidies to Debt Financing

Flow-to-Equity (FTE)

- LCF = UCF - $(1 - T_C) \times r_B \times B$
- PV_{LCF} = Present value of LCF
- FTE = PV_{LCF} - Portion of initial investment from equity
- Required return on levered equity (r_S)
- $r_S = r_0 + B/S_L \times (1 - T_C) \times (r_0 - r_B)$

Weighted-Average-Cost-of-Capital

- Discount rate: r_{WACC}
- PV_{UCF}: PV of Unlevered Cash Flows
- Value = PV_{UCF} - Initial investment for entire project

Summary: APV, FTE, and WACC

	APV	**WACC**	**FTE**
Initial Investment	All	All	Equity Portion
Cash Flows	UCF	UCF	LCF
Discount Rates	r_0	r_{WACC}	r_S
PV of financing	Yes	No	No

Which is best?

- Use WACC and FTE when the debt *ratio* is constant
- Use APV when the *level* of debt is known.

Example p. 437: Project

Cash inflows	500
Cash costs	360
Operating income	140
Corporate tax	47.6
Unlevered cash flow	92.4
Cost of project	475

APV

- Physical asset of project is discounted at .2.
- NPV = 92.4/.2 - 475 = 462 - 475 = -13
- Borrowing 126.2295 (from B/S = 1/3)
- $r_B = .1$
- NPVF = T_C x B = 42.918
- APV = -13 + 42.918 = 29.918

APV recap

- Value = 475 + 29.918 = 504.918
- Debt = <u>- 126.2295</u>
- Equity = 378.6885
- Debt/Equity = 1/3
- Debt/(Debt + Equity) = 1/4

Flow to Equity

Cash inflows		500
Cash costs	-	360
Interest		- 12.62295
Income after interest		127.37705
Corporate tax		- 43.3082
Levered cash flow		84.06885

FTE (continued)

Cost	475
Borrowing	- <u>126.2295</u>
Cost to equity	348.7705

FTE: Required return on equity

- $r_S = r_0 + (B/S)(1-T_C)(r_0 - r_B)$
- B/S = 1/3
- $r_S = .2 + (1/3)(.66)(.2-.1) = .222$

FTE valuation

- NPV =
- - 348.7705 + 84.06885/.22…
- = 29.918
- Same as in APV method.
- Now, same thing with WACC.

Find r_{WACC}

- $r_{WACC} = (S/(S+B))r_S+(B/(B+S))(1-T_C)r_B$
- $=(3/4)(.222) + (1/4)(.66)(.1)$
- $= .183$

WACC method continued

- NPV =
- \- 475 + 92.4/.183
- = 29.918
- All methods give the same thing.

Example: Start-up, all debt financed.

- Cost of project = 30
- CF of project 10 before tax, 6.6 after.
- Discount rate for an all equity firm .2.
- NPV = 6.6/.2 - 30 = 3

More APV example

- Tax shield from borrowing 30 at r_B=.1 = .1(30).34 = 1.02.
- Discounted value = NPVF = 10.2.
- APV = 3 + 10.2 = 13.2.

Leverage of the start-up

- Not 100%.
- Value is 30 + 13.2.
- B = 30,   S = 13.2
- S/(B+S) = .305555555
- (can't expect a round number here)

Example continued. Do it again

- Another project, same as before.
- Retain debt-equity ratio.
- $r_{WACC} =$ $(S/(B+S))r_S + (B/(B+S))r_B(1\text{-}T_C)$
- $r_{WACC} = .30555555r_S + .694444\ r_B\ (.66)$
- $r_S = r_0 + (B/S)(1\text{-}T_C)(r_0 - r_B)$
- $r_{WACC} = .15277777$

Value, using r_{WACC}

- NPV = -30 + 6.6/.1527777
- =13.2
- Lesson: WACC works when the debt equity ratio is established before the project and retained thereafter.
- APV works when the project changes the debt equity ratio

Cash flows to equity

- Cost to equity = 0
- CF's = (10-3)*.66 = 6.6-3*.66=.462
- $r_S = r_0 + (B/S)*(r_0 - r_{B)})(1- T_C)$
- r_S = .35
- NPV = 4.62/.35 = 13.2

Review item

- Complete the following statement and explain briefly: nothing matters in finance except ____________ and ___________.

Answer: taxes and bankruptcy

- Explanation. Because of homemade leverage, capital structure doesn’t matter in the absence of taxes and bankruptcy.
- Taxes matter because debt generates tax shields.
- Bankruptcy matters because financial distress damages the assets of the firm.

Valuation with Corporate Taxes: WACC, APV and FTE methods

Gestão Financeira II

Undergraduate Courses

2010-2011

Instituto Superior de Economia e Gestão
UNIVERSIDADE TÉCNICA DE LISBOA

Valuation of Firms and Projects

- We consider the following assumptions to start with, and introduce the three methods:
  1. The project has average risk (same risk as the firm);
  2. The firm's **D/E ratio is constant** (r_E and r_{wacc} will be constant);
  3. Corporate Taxes are the only imperfection.
  - **WACC: Weighted Average Cost of Capital;**
  - **APV: Adjusted Present Value;**
  - **FTE: Flow to Equity.**
- We them consider alternative Leverage Policies, for which the APV method is more convenient to use:
  - **Constant Interest Coverage Ratio**;
  - Predetermined Debt Levels.

Constant D/E ratio: WACC Method

- Remember what the weighted average cost of capital is:

$$\boxed{r_{wacc} = \frac{E}{E + D} r_E + \frac{D}{E + D} r_D (1 - \tau_c)}$$

- An investment's initial levered value is given by the present value of the FCFs discounted at the rate r_{wacc}:

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

Constant D/E ratio: WACC Method

- Example: Avco, Inc. Is a manufacturer of custom packaging products, and is considering introducing a new line of packaging (the RFX series). The spreadsheet forecasts the project's expected FCFs:

	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**

Constant D/E ratio: WACC Method

- To determine the firm's r_{wacc} we need the market values (when possible) of Equity and of net Debt, as well as the cost of equity (r_E), the cost of debt (r_D) and the corporate tax rate (Tc):

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		

$$r_{wacc} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D (1 - \tau_c) = \frac{300}{600}(10\%) + \frac{300}{600}(6\%)(1 - 0.40) = 6.8\%$$

- Note that net debt D=320-20; and that D/(D+E)=0.5, or D/E=1.

Constant D/E ratio: WACC Method

- The value of the project, including the tax shield from debt, is calculated as the present value of its future free cash flows.
- We are assuming that the project uses the same capital structure, target D/E=1.

$$V_0^L = \frac{18}{1.068} + \frac{18}{1.068^2} + \frac{18}{1.068^3} + \frac{18}{1.068^4} = \$61.25 \text{ million}$$

  – The NPV of the project is \$33.25 million
    – \$61.25 million – \$28 million = \$33.25 million

Constant D/E ratio: WACC Method Summary

1. Determine the free cash flow of the investment.
2. Compute the weighted average cost of capital.
3. Compute the value of the investment, including the tax benefit of leverage, by discounting the free cash flow of the investment using the WACC.

Constant D/E ratio: Implementing the constant D/E ratio

- In the example just seen we considered a constant ratio D/E=1 or D/(D+E)=0.5.
- By this we mean that – every year – the value of Debt is 50% of the (present) value of the project. Debt Capacity is a fixed proportion of V_L.
- So we know that in the beginning (time 0) the new debt that the firm must raise for the RFX project is:

$$D_0 = 0.5 \times 61.25\% = 30.62$$

Constant D/E ratio: Implementing the constant D/E ratio

- For each year, as time passes, we can recumpute V_t^L and D_t.

	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 (at $d = 50\%$)**	**30.62**	**23.71**	**16.32**	**8.43**	—

- For example: after the first year passes,

$$V_1^L = \frac{18}{(1+0.068)} + \frac{18}{(1+0.068)^2} + \frac{18}{(1+0.068)^3} = 47.41$$

$$D_1 = 0.5 \times 47.41 = 23.71$$

Constant D/E ratio: APV Method

- The Adjusted Present Value (APV) method is an alternative to the WACC method.
- If first values the project as if it were unlevered: V^U
- And separately adds the present value of the interest tax shield.

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

Constant D/E ratio: APV Method

- In the first step, the APV method determines the unlevered value of the firm, by discounting the FCFs at the unlevered cos of capital r_U or Pre-Tax WACC.

$$\boxed{r_U = \frac{E}{E + D} r_E + \frac{D}{E + D} r_D = \text{Pretax WACC}}$$

- In Avco's RFX project Example:

$$\boxed{r_U = 0.50 \times 10.0\% + 0.50 \times 6.0\% = 8.0\%}$$

$$\boxed{V^U = \frac{18}{1.08} + \frac{18}{1.08^2} + \frac{18}{1.08^3} + \frac{18}{1.08^4} = \$59.62 \text{ million}}$$

Constant D/E ratio: APV Method

- In the second step of the APV method we compute the present value of the interest tax shield.
- Note this is easy (possible!) after knowing the the Debt Capacity in each year...
- From the Debt Capacity we estimate the annual interest payments:

$$\boxed{\text{Interest paid in year } t \;=\; r_D \times D_{t-1}}$$

  – The interest tax shield is equal to the interest paid multiplied by the corporate tax rate.
- Note: With a target D/E ratio the WACC method is more convenient)

Constant D/E ratio: APV Method

- We compute the Annual Interest Tax Shields:

	Year	0	1	2	3	4
Interest Tax Shield ($ million)						
1	**Debt Capacity, D_t**	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 $\tau_c = 40\%$)**		**0.73**	**0.57**	**0.39**	**0.20**

- And the present value of the interest tax shields, by discounting them at the unlevered cost of capital r_U (or Pre-Tax WACC).

$$PV(\text{interest tax shield}) = \frac{0.73}{1.08} + \frac{0.57}{1.08^2} + \frac{0.39}{1.08^3} + \frac{0.20}{1.08^4} = \$1.63 \text{ million}$$

*Note: 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**.*

Constant D/E ratio: APV Method

- Finally we get the same Levered Value for the project, as with the WACCC method:

$$\boxed{V^L = V^U + PV(\text{interest tax shield}) = 59.62 + 1.63 = \$61.25 \text{ million}}$$

- The difficulty with applying the APV method is when the debt capacity is not known, but just the target D/E ratio. In that the case you would need to determine simultaneously V_t^L and D_t.

Constant D/E ratio: APV Method Summary

1. Determine the investment's value without leverage.

2. Determine the present value of the interest tax shield.
   a. Determine the expected interest tax shield.
   b. Discount the interest tax shield.

3. Add the unlevered value to the present value of the interest tax shield to determine the value of the investment with leverage.

Constant D/E ratio: FTE Method

- The Flow-to-Equity method is:
  - A valuation method that calculates the free cash flow available to equity holders, FCFE, *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.
  - Gives you the value of Equity – same as V_L-D.

Constant D/E ratio: FTE Method

- The method starts by calculating the FCFE, which can be obtained by adjusting the FCF:

$$FCFE_t = FCF_t - (1-\tau_C) \times \text{InterestPayments}_t + \text{Net Borrowing}_t$$

or

$$FCFE_t = \text{Net Income}_t + \text{Depreciation}_t - \text{Capital Expenditures}_t - \text{Increases in NWC}_t + \text{Net Borrowing}_t$$

- The Net Borrowing of a certain year is the change in the level of debt from the previous year:

$$\text{Net Borrowing at Date } t = D_t - D_{t-1}$$

Constant D/E ratio: FTE Method

- In the Avco Example, compute the FCFE:

TABLE 18.7 SPREADSHEET — Computing FCFE from FCF for Avco's RFX Project

	Year	0	1	2	3	4
	Free Cash Flow to Equity ($ million)					
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

Year	0	1	2	3	4
EBIT	**-6,67**	**20,00**	**20,00**	**20,00**	**20,00**
Interest Expenses	**0**	**1,84**	**1,42**	**0,98**	**0,51**
PreTax Income	-6,67	18,16	18,58	19,02	19,49
Income Tax (40%)	-2,67	7,26	7,43	7,61	7,80
Net Income	**-4,00**	**10,90**	**11,15**	**11,41**	**11,70**
+ Depreciation	0,00	6,00	6,00	6,00	6,00
- Capital Expenditures	-24,00	0,00	0,00	0,00	0,00
- Increases in NWC	0,00	0,00	0,00	0,00	0,00
+ Net Borrowing	30,62	-6,92	-7,39	-7,89	-8,43
Free Cash Flow to Equity	**2,62**	**9,98**	**9,76**	**9,52**	**9,27**

Constant D/E ratio: FTE Method

- Because the FCFE is for equity-holders only, we compute the net present value of the Equity invested in the project as the present value of the FCFEs, discounted at the equity cost of capital, r_E.

$$NPV(FCFE) = 2.62 + \frac{9.98}{1.10} + \frac{9.76}{1.10^2} + \frac{9.52}{1.10^3} + \frac{9.27}{1.10^4} = \$33.25 \text{ million}$$

- This is the same NPV we saw with the WACC method and with the APV method.
- Note: The FTE method is only easy to apply when we know the interest payments each year.

Constant D/E ratio: FTE Method Summary

1. Determine the free cash flow to equity of the investment.
2. Determine the equity cost of capital.
3. Compute the equity value by discounting the free cash flow to equity using the equity cost of capital.

Project-Based Cost of Capital

- It is quite possible that firms use a different capital structure when financing a new project, or that a new project is not in the same line of business.
- In this case the "old" discount rates of the firm should not be used for the project.
- How to calculate the cost of capital for the project's mcash flows when a project's risk and leverage differ from the firm?

Project-Based Cost of Capital: (i) Estimating the Unlevered Cost of Capital

- Example: Suppose Avco launches a new plastics manufacturing division.
- We can estimate r_U for the plastics division by looking at other single-division plastics firms that have similar business risks (Comparables).

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%

- For each competitor we get:

$$\text{Competitor 1: } r_U = 0.60 \times 12.0\% + 0.40 \times 6.0\% = 9.6\%$$

$$\text{Competitor 2: } r_U = 0.75 \times 10.7\% + 0.25 \times 5.5\% = 9.4\%$$

- For the average project in the plastics industry:

$$\boxed{r_U = 9.5\%}$$

Project-Based Cost of Capital: (i) Project Leverage and the Equity Cost of Capital

- Knowing r_U allows us to use the APV method.
- To use the WACC or the FTE methods, we need to assess the cost of equity r_E for the project.
- With a target D/E ratio we use MMII:

$$\boxed{r_E = r_U + \frac{D}{E}(r_U - r_D)}$$

- In the Avco plastics division Example (D/E=1, r_U=9.5%, and r_D=6% for Avco):

$$\boxed{r_E = 9.5\% + \frac{0.50}{0.50}(9.5\% - 6\%) = 13.0\%}$$

Project-Based Cost of Capital: (ii) Project Leverage and the WACC

- The weighted average cost of capital for the project in the plastics division would be

$$\boxed{r_{WACC} = 0.50 \times 13.0\% + 0.50 \times 6.0\% \times (1 - 0.40) = 8.3\%}$$

- If the target D/E ratio were different for this project, we would use the unlevered rate r_U=9.5% of the project's industry, and compute r_E and r_{wacc} based on the new D/E ratio.

$$\text{Suppose}\frac{D}{E} = 0.75$$

$$r_E = 9.5\% + 0.75(9.5\% - 6\%) = 12.125\%$$

$$r_{wacc} = \frac{1}{1+0.75}12.125\% + \frac{0.75}{1+0.75}6\%(1-40\%) = 8.47\%$$

Project-Based Cost of Capital: (ii) Project Leverage and the WACC

- Indeed, knowing a project's (industry's) unlevered cost of capital, is crucial to determine the WACC rate under different target leverage ratios.
- An alternative way of re-estimating rate WACC when target ratio D/E changes is:

$$\boxed{r_{wacc} = r_U - \frac{D}{E+D}\tau_c r_D}$$

- In the last example of slide 24 we can confirm:

$$r_{wacc} = 9.5\% - \frac{0.75}{1+0.75}40\% \times 6\% = 8.47\%$$

Project-Based Cost of Capital: (iii) Determining the Incremental Leverage of a Project

- For capital budgeting purposes, the project's financing is the incremental financing that results from the firm taking the project.
- Things to remember:
  - Cash is Negative Debt: if an investment reduces the firm's cash holdings, it's equivalent to the firm adding debt;
  - A Fixed Equity Payout policy implies 100% Debt Financing: if the payout policy is not affected by a new project, then that project must be financed with $D/(E+D)=1$.

APV Method with Other Leverage Policies

- Besides the policy of keeping a target ratio D/E, there are other common leverage policies.
- We will have a look at 2 cases, which are well captured by the APV method:
  - Constant Interest Coverage Ratio;
  - Predetermined Debt Levels.

APV Method: Constant Interest Coverage Ratio

- When a firm keeps its interest payments equal to a target fraction of its free cash flows we say it has a constant interest coverage ratio.
  - If the target fraction is *k*, then:

$$\boxed{\text{Interest Paid in Year } t \; = \; k \; \times \; FCF_t}$$

- To implement the APV approach, the present value of the tax shield under this policy needs to be computed:

$$\boxed{\begin{aligned} PV(\text{Interest Tax Shield}) \; &= \; PV(\tau_c k \; \times \; FCF \;) \; = \; \tau_c k \; \times PV(FCF \;) \\ &= \tau_c k \; \times V^U \end{aligned}}$$

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

APV Method: Constant Interest Rate Coverage

- The value of the levered project, using the APV method, is:
  - Levered Value with a Constant Interest Coverage Ratio

$$\boxed{\begin{aligned} V^L &= V^U + PV(\text{interest tax shield}) = V^U + \tau_c k \times V^U \\ &= (1 + \tau_c k)V^U \end{aligned}}$$

- Example: In the Avco RFX project, if the firm plans to use debt such that interest is always 20% of the FCF, the value of the levered project is:

$$V^L = (1 + 0.4 \times 20\%)\$59.62 = \$64.39 \text{ million}$$

APV Method: Predetermined Debt Levels

- A firm may adjust its debt according to a fixed schedule that is known in advance.
- Example: For the RFX project, assume now that Avco plans to borrow \$30.62 million and then will reduce the debt on a fixed schedule:
  - to \$20 million after one year, to \$10 million after two years, and to zero after three years.

APV Method: Predetermined Debt Levels

	Year	0	1	2	3	4
Interest Tax Shield ($ million)						
1	**Debt Capacity, D_t**	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**	—

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

$$PV(\text{interest tax shield}) = \frac{0.73}{1.06} + \frac{0.48}{1.06^2} + \frac{0.24}{1.06^3} = \$1.32 \text{ million}$$

APV Method: Predetermined Debt Levels

- If debt had a constant predetermined level D forever, we would actually get:

$$V^L = V^U + \tau_C D$$

Three discount methods for valuing projects and the required return on equity

Fecha de recepción: 26/04/2011 Fecha de aceptación: 29/08/2011

Marc B.J. Schauten
Erasmus School of Economics
schauten@ese.eur.nl

Abstract

In this paper we discuss the required return on equity for a simple project with a finite life. To determine a project's cost of equity, it is quite common to use Modigliani and Miller's Proposition II (1963). However, if the assumptions of MM do not hold, Proposition II will lead to wrong required returns and project values. This paper gives an example of how the cost of equity should be determined in order to obtain correct valuations. The methods we apply are the Adjusted Present Value method, the Cash Flow to Equity method and the WACC method.

Keywords: Proposition II, net present value, APV, CFE, WACC.

JEL classification: G12; G31; G32; H43

Tres métodos de descuento para valuar proyectos y la tasa requerida de rendimiento para el capital accionario

Resumen

En este artículo analizamos el rendimiento requerido para el capital accionario en un proyecto simple con vida finita. Es muy común el uso de la Proposición II de Modigliani y Miller (1963) para determinar el costo del capital accionario de un proyecto. No obstante, si los supuestos de MM no se mantienen, la Proposición II llevará a rendimientos requeridos y valores del proyecto erróneos. Este trabajo brinda un ejemplo de cómo el costo del capital accionario puede determinarse de forma que se obtengan valuaciones correctas. Los métodos que aplicamos son el del Valor Presente Ajustado, el del Flujo de Efectivo a Capital y el método del CPPC.

Palabras clave: proposición II, valor presente neto, APV, CFE, CPPC

Clasificación JEL: G12; G31; G32; H43

Introduction

The value of a project can be calculated using the 'Adjusted Present Value' (APV) method, the 'Cash Flow to Equity' (CFE) method and the 'Weighted Average Cost of Capital' (WACC) method. According to the APV-method the value of a project equals the present value of the expected cash flows as if the project is all equity financed plus the present value of the tax shields (PVTS) due to debt financing.[1] The CFE-method discounts the after-tax cash flows to the equity holders at the cost of equity. The WACC-method discounts the after-tax cash flows at the weighted average cost of equity (E) and debt (D). Two versions of the WACC-method can be identified. The first version calculates the after-tax cash flows as if the project is all equity financed ('Free Cash Flows' or 'FCFs'. The advantage of debt financing is expressed in a lower discount rate. The second version, as presented by Ruback et al. (2002) discounts the expected after-tax cash flows ('Cash Flows to Capital' or 'CFC's) at a weighted average cost without taking the tax advantage of debt financing into account.

[1]Since interest payments reduce taxable income. We ignore the value of other 'side effects'.

In this paper we focus on the valuation of a fictitious project with a finite life. We apply the APV-method, the CFE-method and the WACC-method. The project is financed with both E and D. The cost of equity (r_E), which needs to be determined in the last two methods, depends on both the business risk and the financial risk. The higher a project's degree of leverage, the higher the financial risk for the equity holders. Often, in calculating r_E, Modigliani and Miller's 'proposition II' is applied. Miller and Modigliani's well-known 'proposition II' states that (1963, equation 12c, p. 439):

$$r_E = r_U + \frac{D}{E}(1-\tau_c)(r_U - r_D), \qquad \text{(MM II)}$$

where r_U is the cost of equity assuming 100% equity financing,[2] τ_c equals the corporate tax rate, r_D[3] equals the cost of debt and E and D denote the market values of equity and debt. Important assumptions used by MM in their derivation are that tax savings are discounted at $r_{D,}$ debt is perpetual and the expected cash flows are perpetual with a growth rate of zero. However, the cash flows of our fictitious project are not perpetual and its leverage is not constant over time, such that application of MM II would lead to *incorrect required returns* which would result in *incorrect project values*. When valuing projects (and companies) this is often overlooked or ignored for simplicity reasons. This paper pursues an alternative approach for the determination of r_E, considering finite projects and a predetermined amount of debt (see Inselbag and Kaufold, 1997[4]). The suggested approach leads to valuations that yield the same results with all of the three valuation methods. Given the assumptions, these valuations are correct and consistent. When applying MM II to the project, this is (unfortunately) not the case.

This introduction is the first section. Section two presents the project. Section three determines the value of the project using the APV-, CFE-, and WACC-method. Section four gives a brief overview of the existing literature on the valuation of the tax shield and the discount rate of the tax shield in particular. This discount rate partially determines r_E. Finally, section five provides a summary.

[2] rU is determined by the business risk of the project; a higher business risk implies a higher rU.
[3] rD is the risk free interest rate in MM1963.
[4] Inselbag and Kaufold (1997) value a fictitious firm with infinite cash flows instead of a finite project as we do.

Project X

The project to be valued, project X, requires an initial investment of € 230 million at t=0. This amount is divided into a € 200 million investment in tangible fixed assets (TFA) and a € 30 million investment in working capital (WC). To finance the investment, € 150 million of debt is issued at t = 0. The maturity of the (bullet) loan is 4 years. The loan pays 8% interest (r_D = 8%) at the end of each year. The market value of debt equals € 150 million at the beginning of each year. The residual of the initial investment (€ 230 million - € 150 million = € 80 million) is financed with equity. The corporate tax rate τ_c is 40%. The forecasted profit- and loss accounts, balance sheets and cash flow statements of the project are reported in Table 1.

Table 1
Forecasted profit & loss accounts, balance sheets and cash flow statements

EBITDA is earnings before interest, tax, depreciation and amortization; EBT is earnings before tax; WC is working capital; TFA is tangible fixed assets; Equity is common stock plus retained earnings. Given balance sheet and cash flow numbers are taken at the end of the year, except for Year 1 where numbers are given for the beginning of the year (Start Year 1) and the end of the year (Year 1). Note that an increase in excess cash has a negative sign in the cash flow statement.

Profit & loss account			**Year 1**	**Year 2**	**Year 3**	**Year 4**
EBITDA			200.0	250.0	280.0	240.0
Depreciation			50.0	50.0	50.0	50.0
EBIT			150.0	200.0	230.0	190.0
Interest			12.0	12.0	12.0	12.0
EBT			138.0	188.0	218.0	178.0
Tax	40%		55.2	75.2	87.2	71.2
Net profit			82.8	112.8	130.8	106.8
Balance sheet		**Start Year 1**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Assets						
WC		30.0	40.0	60.0	70.0	0.0
Excess cash			122.8	265.6	436.4	513.2
TFA		200.0	200.0	200.0	200.0	200.0
Depreciation cumulative			50.0	100.0	150.0	200.0
Book value TFA		200.0	150.0	100.0	50.0	0.0
Total		230.0	312.8	425.6	556.4	513.2
Liabilities						
Equity		80.0	162.8	275.6	406.4	513.2
Debt	8%	150.0	150.0	150.0	150.0	0.0
Total		230.0	312.8	425.6	556.4	513.2

Cash flow statement	Start Year 1	Year 1	Year 2	Year 3	Year 4
EBIT	0.0	150.0	200.0	230.0	190.0
Depreciation	0.0	50.0	50.0	50.0	50.0
Operational cash flow	0.0	200.0	250.0	280.0	240.0
Investment in WC	-30.0	-10.0	-20.0	-10.0	70.0
Investment in TFA	-200.0	0.0	0.0	0.0	0.0
Interest		-12.0	-12.0	-12.0	-12.0
Redemption		0.0	0.0	0.0	-150.0
Tax		-55.2	-75.2	-87.2	-71.2
Dividend		0.0	0.0	0.0	0.0
Cash flow financing		-67.2	-87.2	-99.2	-233.2
Issuance equity	80.0	0.0	0.0	0.0	0.0
Issuance debt	150.0	0.0	0.0	0.0	0.0
Excess cash		-122.8	-142.8	-170.8	-76.8
Total		0.0	0.0	0.0	0.0

Note that dividends in the cash flow statements are set to zero. Actual dividends are probably higher than zero. The zeros could subsequently be interpreted as wrong and of influence on the outcome of the valuation. This —however— is not the case. The item dividend is —as well as the item excess cash in the balance sheets— ignored when we calculate the free cash flows needed for the valuations in The AVP and WACC methods. The value of a project is determined by the present value of free cash flows generated by the project. This free cash flow is not influenced by dividend policy. Whether the actual cash generated is invested in a zero NPV savings account and paid out later or paid out directly as dividend is irrelevant for the valuation of the project. Of course, if one applies the ECF method, then the most convenient way to calculate the equity cash flow is to assume that the net cash generated is each year directly paid to the shareholders as dividend. It is of course possible to incorporate the ECFs (see CFE method) in the cash flow statement and the balance sheet. This would of course increase the 'cash (out)flow financing' item in the cash flow statements and would decrease 'equity' in the balance sheets. But it will not influence the outcomes of the valuations.[5]

[5]Note that we should not make the mistake by adding possible expected 'returns' from the excess amount of cash to the (EBIT and) operational cash flow. The project would then be overvalued. An example: assume the expected cash flow at t = 1 is 110 and the opportunity cost of capital is 10%. The present value of this cash flow at t = 0 then is 100. It is wrong to add to this 100 the present value of the expected return during period 2 (e.g. the present value of 10% of 110). If you want to include this extra revenue then you should discount the expected cash flow at t = 2; 121 / 1.12 = 100.

The APV, CFE and WACC methods

The APV method

According to the APV method, the value of the project at time t ($V_{L,t} = E_t + D_t$) equals the value of the project as if it was all-equity financed plus the present value of the tax shields at time t, $PVTS_{t,}$:

$$V_{L,t} = V_{U,t} + PVTS_t \tag{1}$$

The project value assuming 100% equity financing at time t equals:

$$V_{u,t} = \sum_{i=t+1}^{4} \frac{cash\ flow_i}{(1+r_u)^{i-t}} \tag{2}$$

where cash $flow_i$ denotes the after-tax cash flow at time i and r_U denotes the cost of capital as if the project was all-equity financed (= free cash flow).

The present value of the tax savings at time t is:

$$PVTS_t = \tau_c \sum_{i=t+1}^{4} \frac{r_D D_{i-1}}{(1+r_D)^{i-t}} \tag{3}$$

where τ_c denotes the corporate tax rate and r_D equals the cost of debt.

The FCF equals the operational cash flow minus the investment in working capital and TFA minus taxes as if the project is 100% equity financed. For example, at the end of year 1 (t = 1) the FCF equals 200 – 10 – (40% x 150) = 130.

Table 2
Free cash flow of project X

	Start Year 1	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Operational cash flow	0	200	250	280	240
Tax as if 100% equity	0	-60	-80	-92	-76
Investment in WC	-30	-10	-20	-10	70
Investment in TFA	-200	0	0	0	0
FCF	-230	130	150	178	234

V_U at t = 0 then equals:[6]

$$V_{U,0} = \frac{130}{1.1} + \frac{150}{1.1^2} + \frac{178}{1.1^3} + \frac{234}{1.1^4} = 535.7$$

This way, we can determine V_U at the beginning of each year. For example, V_U at the beginning of year 4 equals:

$$V_{U,3} = \frac{234}{1.1} = 212.7$$

Table 3 reports the values of project X at the beginning of the years 1-4, assuming that the project is all-equity financed.

Table 3
V_U at the start of year t

	Year 1	Year 2	Year 3	Year 4
V_u start year t	535.7	459.3	355.2	212.7

The PVTS at the beginning of year 1 equals (see Equation 3):

$$PVTS_0 = 0.4\left[\frac{0.08\times 150}{1.08} + \frac{0.08\times 150}{1.08^2} + \frac{0.08\times 150}{1.08^3} + \frac{0.08\times 150}{1.08^4}\right] = 15.9$$

The PVTS at t=0 is the present value of the tax shields due to debt financing in year 1-4. The interest payment at the end of each year is 12. Compared to all-equity financing, the tax payment is 0.4 x 12 (=τ_c x interest) lower per year. Since the amount of debt is independent of the value of the project, the tax savings and the interest payments are assumed to have the same risk profile. Therefore, the present value of tax savings is calculated using the discount rate r_D (= 8%).

This way, we can determine PVTS at the beginning of each year. For example, the PVTS at the beginning of year 4 equals:

$$PVTS_3 = 0.4\left[\frac{0.08\times 150}{1.08}\right] = 4.4$$

[6] t = 0 denotes the beginning of period 1, t = 1 the beginning of period 2 etc.

Table 4 reports the values of project X at the beginning of the years 1-4.

Table 4
$V_{U,t}$, $PVTS_t$, $V_{L,t}$ at the start of each year

	Year 1	Year 2	Year 3	Year 4
V_u at start year t	535.7	459.3	355.2	212.7
PVTS at start year t	15.9	12.4	8.6	4.4
V_L at start year t	551.6	471.6	363.8	217.2
Value D at start year t	150.0	150.0	150.0	150.0
Value E at start year t	401.6	321.6	213.8	67.2

The total project value ($V_L = V_U + PVTS$) at the beginning of year 1 equals 551.6 (=535.7 + 15.9). The market value of equity at the beginning of the first year equals 551.6 minus the market value of debt: 551.6–150=401.6. The equity providers initially invested 80.0 (=230–150), while the market value equals 401.6. This gives a net present value (NPV) of the project for the equity holders of 401.6–80.0=321.6.[7]

The CFE method

The market value of equity at the beginning of year 1-4 can also be determined by discounting the CFEs with r_E as discount rate. The CFE in year t equals the operational cash flow minus the investment in working capital and TFA minus interest (and redemption) paid minus the actual corporate taxes paid, all in year t. Table 5 reports the CFEs for year 1-4. For example, the CFE at the end of year 1 equals: 200-10-12-55.2= 122.8. The CFE at the beginning of year 1 equals the deposit of € 80 million to partially finance the investment expense of € 230 million at t=0.

[7]Obviously, the NPV for the debt holders is equal to zero. The market value of the loan at the beginning of year 1 equals the amount supplied by the providers of debt at t=0 (€ 150 million).

Table 5
CFEs at the end of year 1-4

	Year 1	Year 2	Year 3	Year 4
Operational cash flow	200.0	250.0	280.0	240.0
Investment in WC	-10.0	-20.0	-10.0	70.0
Investment in TFA	0.0	0.0	0.0	0.0
Interest and redemption	-12.0	-12.0	-12.0	-162.0
Tax	-55.2	-75.2	-87.2	-71.2
CFE	*122.8*	*142.8*	*170.8*	*76.8*

R_E is determined by the business risk of the project and the financial risk due to debt financing. As mentioned before, the business risk determines R_U and equals 10% in the year 1-4. Financial risk for the equity holders is determined by the relative amount of debt. The leverage varies over the lifetime of the project; see Table 4. For example, the D/E ratio is 37% (=150/401.6) at the beginning of year 1 and 223% (= 150 / 67.2) at the beginning of year 4. Because the financial risk is fluctuating, r_E is fluctuating as well. Following Inselbag and Kaufold (1997) we derive an 'adjusted proposition II' for r_E. Let's start with the basic balance sheet identity. The total value of project X at time t equals:

$$D_t + E_t = V_{u,t} + PVTS_t \tag{4}$$

The value increase required by the equity- and debt holders over period t (for example from t = 0 to t = 1) equals $D_t(r_D) + E_t(r_{E,t})$. This value increase equals $V_{u,t}(r_u) + PVTS_t(r_D)$. V_u yields a return equal to r_U and, as the PVTS faces the same risk as the debt, the PVTS yields a return equal to r_D:

$$D_t(r_D) + E_t(r_{E,t}) = V_{u,t}(r_u) + PVTS_t(r_D) \tag{5}$$

From (5) it follows, after rearranging, that[8]:

$$r_{E,t} = r_U + \frac{(D_t - PVTS_t)}{E_t}(r_U - r_D) \tag{6}$$

Equation (6) reflects the general formula for the required return on equity under the assumption that the discount rate for the tax shields is equal to r_D. Only if the PVTS

[8]See appendix AI.

of a project is equal to τ_c x $D_{t=0}$ equation (6) can be rewritten as proposition II of MM (MMII).[9] For project X, using equation (6) $r_{E,t}$ can be calculated for the years 1 to 4. This requires entering the computed values resulting from the APV-method (see Table 4) in (6). For year 1, this yields a required rate of return on equity of:

$$r_{E,1} = 0.1 + \frac{(150 - 15.9)}{401.6}(0.1 - 0.08) = 0.10668$$

Table 6 reports the r_Es for year 1-4. We notice an increase in R_E from 10.668% in year 1 to 14.334% in year 4. The required return increases, because of an increase in the ratio (D – PVTS) / (E).

Table 6
Required return on equity in year 1-4

	Year 1	Year 2	Year 3	Year 4
$R_{E,t}$	0.10668	0.10856	0.11323	0.14334
$1 + R_{E,t}$	1.10668	1.10856	1.11323	1.14334
$\Pi\,(1+ R_{E,t})$	1.10668	1.22682	1.36573	1.56150

Naturally, R_E in year t equals the CFE_t (see Table 5) plus the value change of equity in year t, divided by the market value of equity at t-1 (see Table 4). For example, $R_{E,1}$ equals [122.8 + (321.6 - 401.6)] / 401.6 = 10.668% and $r_{E,4}$ equals [76.8 + (67.2 - 213.8)] / 213.8 = 14.334%.

The value of equity at the beginning of year 1 is the present value of the expected ECFs:

$$E_0 = \frac{(CF\,E_{year\,1})}{(1+r_{E,1})} + \frac{(CFE_{year\,2})}{(1+r_{E,1})(1+r_{E,2})} + \frac{(CFE_{year\,3})}{(1+r_{E,1})(1+r_{E,2})(1+r_{E,3})} + \frac{(CFE_{year\,4})}{(1+r_{E,1})(1+r_{E,2})(1+r_{E,3})(1+r_{E,4})} \quad (7)$$

If we insert in the numbers from Table 5 and Table 6 we find:

$$E_0 = \frac{(122.8)}{(1.10668)} + \frac{(142.8)}{(1.22682)} + \frac{(170.8)}{(1.36573)} + \frac{(76.8)}{(1.56150)} = 401.6$$

[9] In their derivation MM assume equal interest payments per year. The annual tax shields are therefore the same every year: τ_c x rD x D. The PVTS at t=0 then equals (τ_c x rD x D) / rD = τ_c x D. The general formula for rE is derived in Appendix C.

And the value of equity at the beginning of, for example, year 4 equals:

$$E_3 = \frac{(76.8)}{(1.1433)} = 67.2$$

The computed equity values match the values resulting from the APV-method (see Table 4). However, this would not have been the case if we would have used MM II instead of Equation 6.[10]

The WACC method

We can identify two versions of the WACC method. The first version calculates the after-tax WACC.[11] This version is most commonly used. The second version uses the before-tax WACC.

Version 1. The project value can be determined by discounting the expected FCFs with the $WACC_{\text{after taxes}}$. The market value of equity at time t then equals the project value at time t minus the debt value at time t. The tax advantage from debt financing is expressed in the discount rate. The WACC for period t equals the weighted average of $r_{D,t}$ after taxes and $r_{E,t}$:

$$WACC_t = r_{D,t}(1-t_c)\frac{D_t}{V_{L,t}} + r_{E,t}\frac{E_t}{V_{L,t}} \tag{8}$$

Using the outcomes from the APV-approach, the WACC can easily be determined. Table 7 reports the market values of equity and debt and the accompanying required returns per year.

[10] If we would use the values obtained from the APV method (Table 4) to determine re in the years 1 to 4 according to MM II, we would find the following required returns for these years: 10.45%, 10.56%, 10.84% and 12.68%. If the CFEs in the years 1 to 4 (Table 5) would be discounted at these rates, the equity value at the beginning of year 1 would be 404.674 instead of 401.606.

[11] This method is also known as the 'textbook WACC'.

Table 7
Required return on debt and equity, project value, market value of debt and equity, and the WACC for year 1-4 according to version 1

	Year 1	Year 2	Year 3	Year 4
$R_{D,t}$	0.0800	0.0800	0.0800	0.0800
$R_{E,t}$	0.1067	0.1086	0.1132	0.1433
V_L at start year t	551.61	471.65	363.77	217.17
Value D at start year t	150.00	150.00	150.00	150.00
Value E at start year t	401.61	321.65	213.77	67.17
$WACC_t$	0.0907	0.0893	0.0863	0.0775
$\Pi\,(1+WACC_t)$	1.0907	1.1881	1.2907	1.3907

The WACC for year 1 then equals:

$$WACC_1 = 0.08(0.6)\frac{150}{551.61} + 0.1067\frac{401.61}{551.61} = 0.0907$$

And the WACC for year 4, for example, equals:

$$WACC_4 = 0.08(0.6)\frac{150}{217.17} + 0.1433\frac{67.17}{217.17} = 0.0775$$

The value of the project (E + D) at the beginning of year 1 equals:

$$V_{L,0} = \frac{(FCF_{year\ 1})}{(1+WACC_1)} + \frac{(FCF_{year\ 2})}{(1+WACC_1)(1+WACC_2)} + \frac{(FCF_{year\ 3})}{(1+WACC_1)(1+WACC_2)(1+WACC_3)} + \frac{(FCF_{year\ 4})}{(1+WACC_1)(1+WACC_2)(1+WACC_3)(1+WACC_4)} \qquad (9)$$

If we insert the numbers from Table 2 and Table 7 we find:

$$V_{L,0} = \frac{(130)}{(1.0907)} + \frac{(150)}{(1.1881)} + \frac{(178)}{(1.2907)} + \frac{(234)}{(1.3907)} = 551.61$$

The value of the project at, for example, the beginning of year 4 equals:

$$V_{L,3} = \frac{(234)}{(1.0775)} = 217.17$$

The computed project values match the computed values resulting from the APV- and the CFE-method.[12]

As an alternative to the $WACC_{after\ taxes}$ the $WACC_{before\ taxes}$ (or $WACC^{CFC}$) can be employed (see Ruback, 2002). Here we can assume that the tax savings are discounted at r_D, as we did before. In applications this can be simplified by assuming that the tax savings are discounted at r_u. Version 2a elaborates on the first situation and version 2b elaborates on the second.[13]

Version 2a. According to version 2a, the project value is calculated by discounting the free cash flow to equity (CFE) and the net cash flow to debt[14] (CFD) at the $WACC_{before\ taxes}$. The difference with respect to version 1 is that the tax advantage is expressed in a higher cash flow instead of a lower discount rate;[15] the sum of CFE and CFD —Cash Flow to Capital (CFC)— is higher than FCF. For example, the CFC in year 1 equals 122.8+12=134.8 and in year 4: 76.8+12+150=238.8, whereas the FCF in year 1 is 130 and 234 in year 4. Table 8 reports the CFC in year 1-4.

Table 8
CFE, CFD and CFC at the end of Year 1-4

	Year 1	Year 2	Year 3	Year 4
CFE	122.8	142.8	170.8	76.8
CFD	12.0	12.0	12.0	162.0
CFC	*134.8*	*154.8*	*182.8*	*238.8*

The WACC in period t equals the weighted average of r_{Dt} before taxes and $r_{E,t}$:

$$WACC_t = r_{D,t}\frac{D_t}{V_{L,t}} + r_{E,t}\frac{E_t}{V_{L,t}} \qquad (10)$$

[12]For the years 1 to 4, WACC according to MMII amounts to, respectively, 8.91%, 8.73%, 8.35% and 7.24%. Here the computed APV-values (Table 4) are used to determine the required returns. This way, the total project value at t = 0 equals 554,830 instead of 551,606. The equity value at t=0 equals 404,830 (554,830 – 150) instead of 401,606.

[13]A general formula for $WACC_{CFC}$ can be derived by taking the weighted average of equation (C1) from Appendix C and r_D with the proportions equity to total value and debt to total value as weighting factors. The final result is: $WACC_{CFC} = r_U - (r_U - r_{TS})(PVTS/V_L)$.

[14]Interest payments plus redemption minus newly issued debt.

[15]Now the actual taxes are deduced instead of the taxes assuming all-equity financing.

This gives a WACC in year 1 of:

$$WACC_1 = 0.08\frac{150}{551.61} + 0.1067\frac{401.61}{551.61} = 0.0994$$

And this gives a WACC in, for example, year 4 of:

$$WACC_4 = 0.08\frac{150}{217.17} + 0.1433\frac{67.17}{217.17} = 0.0996$$

Table 9 reports all WACC resulting from version 2a. These WACCs are higher than the WACCs under version 1, see Table 7.

Table 9
WACC for Year 1-4 according to version 2a

	Year 1	**Year 2**	**Year 3**	**Year 4**
$WACC_t$	0.0994	0.0995	0.0995	0.0996
$\Pi(1+WACC_t)$	1.0994	1.2088	1.3291	1.4615

Project value (E + D) at the beginning of year 1 equals:

$$V_{L,0} = \frac{(134.8)}{(1.0994)} + \frac{(154.8)}{(1.2088)} + \frac{(182.8)}{(1.3291)} + \frac{(238.8)}{(1.4615)} = 551.6$$

Project value at, for example, the beginning of year 4 equals:

$$V_{L,3} = \frac{(238.8)}{(1.0996)} = 217.2$$

For valuations in practice, version 1 and 2a are not very useful. After all, the market values of equity, debt and r_E are required in order to calculate the WACC (after tax as well as before tax).

Version 2b. Following Ruback (2002), we can also use r_U instead of r_D as discount rate for the tax shield. This gives version 2 direct application possibilities, since calculating the PVTS by discounting the tax shield at r_U has the following effect on equation (5):

$$D_t(r_D)+E_t(r_{E,t}) = V_{u,t}(r_U) + PVTS_t(r_U) \qquad (5')$$

The value increase required by the equity and debt holders over period t equals the weighted average returns of V_U and the PVTS. As V_u and the PVTS yield the same return, the $WACC_{before\ tax}$ is independent of the PVTS/V_U–ratio and is independent of the leverage ratio. After all, the amount of debt is one of the determinants of the PVTS. In other words, the $WACC_{before\ taxes}$ is every year equal to r_u and does not depend on the capital structure.

If the CFCs (see Table 8) are discounted at the $WACC_{before\ taxes}$ (=10%), we obtain a market value of 550.92 at t=0. The market value of equity then is 550.92–150=400.92. The project values are reported in Table 10. Naturally, by applying the APV-method and the CFE-method, the same values are obtained. By applying the APV-method, we now use r_U as discount rate for the tax shield. By applying the CFE-method, the CFEs (see Table 8) are discounted at an adjusted r_E.[16] It catches the eye that the market values turn out a little lower than they did in Table 7. This is not surprising as r_U (being the discount rate for the tax shield) is higher than r_D.

Table 10
Required return on debt and equity, project value, market value of debt and equity, and the WACC for Year 1-4 according to version 2b

	Year 1	Year 2	Year 3	Year 4
$R_{D,t}$	0.0800	0.0800	0.0800	0.0800
$R_{E,t}$	0.1075	0.1093	0.1140	0.1447
V_L at start year t	550.92	471.22	363.54	217.09
Value D at start year t	150.00	150.00	150.00	150.00
Value E at start year t	400.92	321.22	213.54	67.09
$WACC_t$	0.1000	0.1000	0.1000	0.1000
$\Pi\ (1+WACC_t)$	1.1000	1.2100	1.3310	1.4641

Summarizing, it can be stated that the $WACC_{before\ taxes}$ can be directly used to determine the value of the project as long as the discount rate for the tax shields is equal to r_U. However, if r_D is used as discount rate for the calculation of the PVTS, applying the WACC-method would be tedious, as for both the WACC version the results of an APV calculation are required. So, if r_D is the discount rate for the PVTS, using the WACC-method is not very likely.[17]

[16] It follows from (5'), after substituting V_L – PVTS for V_U and rearranging, that: $r_e = r_u + \frac{D}{E}(r_u - r_D)$. See Appendix B.

[17] The cash flow to capital (CFC) method as proposed by Ruback (2002) cannot be applied directly when a target capital structure is pursued. The $WACC_{before\ taxes}$ indeed equals r_U, but the CFCs cannot be determined directly. Namely, the yearly CFC partially depends on the amount of D. When a target capital structure is pursued the amount of D is a percentage of the unknown total project value at the beginning of each year.

The relation between the valuation of tax shields and the cost of equity

The required return on equity of a particular project (or firm) is among other things based on the chosen discount rate for the expected tax shields (r_{TS}) from interest bearing debt and the present value of the tax shields in relation to the unlevered value of the project.[18] As long as the discount rate for the tax shields is lower than r_U, the relation between the required return on equity and the ratio PVTS to V_U is —ceteris paribus— negative. And if the discount rate is equal to r_U, there is no relation. The explanation for this is simple. The total cost of capital, i.e. the weighted average of r_E and r_D, is determined by the risk of the assets. As long as the level of risk of the PVTS is lower than the risk of V_U, the total risk of the assets reduces with PVTS. And if the level of risk of the PVTS is the same as the risk of V_U, the ratio PVTS to V_U is of no influence on the total risk of the assets and neither on r_E.

What can we say about the discount rate of the tax shields and the size of the PVTS? Miller and Modigliani (1963) assume that the risk free interest rate is the correct discount rate. And given non growing perpetual cash flows, the PVTS is equal to corporate tax rate times the amount of interest bearing debt.[19] The relation between the cost of equity and leverage is then correctly reflected by (MM II). If the amount of debt is a growing perpetual with a constant growth rate g, then the PVTS as a percentage of the value of the project depends on g. And as long as the discount rate of the tax shields is lower than r_U, the required return on equity is negatively related to growth. The cost of equity decreases with the growth rate since the influence of growth on the PVTS is stronger than it is on Vu. If we assume that the discount rate of the PVTS is r_U, g is again irrevelevant for r_E. See Ehrhart and Daves (2002) for an overview of relations between the cost of capital and g.

If cash flows are not (growing) perpetuals, and if the discount rate for the tax shields is not equal to r_U, we need to know the level of risk (r_{TS}) and the PVTS in relation to firm value in order to determine r_E. (See Appendix C for a derivation of the general formula for r_E). The academic literature so far isn't unambiguous in its choice of the discount rate for the tax shields —and as a result of that it is unambiguous about the cost of equity and the WACC as well. In literature a distinction is

[18]Of course the return on equity is also positively influenced by the financial risk due to leverage. The higher the ratio D/E, the higher r_E.

[19]If debt is not riskless we replace the riskless rate by the cost of debt.

often made between a fixed debt policy (the levels of debt are predetermined) and a situation where the level of debt is defined as a percentage of firm value. Analyzing the case of a fixed debt policy, Myers (1974) states that tax shields should be discounted at r_D, the debt holders' required rate of return. Luehrman (1997) also underwrites this discount rate. Harris and Pringle (1985), Ruback (2002), Kaplan and Ruback (1995), Brealey *et al*. (2008) and Berk and DeMarzo (2011) state that r_U is the appropriate discount rate for tax shields if firms follow a target debt ratio. They reason by saying that the systematic risk of the PVTS equals that of the operational activities of the firm/the project. Miles and Ezzel (1980) and Lewellen and Emery (1986) state that, when the companies follow a target debt ratio, r_D is the appropriate discount rate in the year in which the debt level is fixed, and r_U in all other years.

The PVTS could also be determined by taking the difference between the present value of the taxes paid by an unlevered firm (G_u) and an identical levered firm (G_l). Figure 1 depicts the *total* value of an unlevered and a levered firm (see Fernandez, 2004).[20] The focus then shifts to the appropriate discount rates for G_u and G_l respectively.[21]

We acknowledge that the choice of a correct discount rate for the tax shield still is a open issue. For now —following Brealey *et al*. (2008) and Berk and DeMarzo (2011)— we share the opinion that r_D is the correct discount rate when following a fixed debt policy, where the debt level is predetermined at the beginning of each year. The risk of the tax shield depends directly on the debt risk. This assumption is applied in the valuation of Project X as well (see The APV, CFE and WACC methods). The level of debt is predetermined as are the expected tax savings due to debt. However, if a target debt ratio is pursued, we recommend using r_U as the appropriate

[20]Although Fernández's derivations leading to his final results are disputable, his conclusion that the present value of tax shields (PVTS) is equal to the difference between the present value of expected taxes paid by the unlevered firm (G_u) and the present value of expected taxes paid by the levered firm (G_l) is valid. For a discussion of the validity of the final results of Fernández (2004), see Fieten *et al*. (2005), Fernández (2005), Arzac and Glosten (2005) and Cooper and Nyborg (2006). According to Fernández (2004), the PVTS for non-growing perpetuities is equal to τD, where τ is the tax rate and D is the market value of debt. PVTS for constant growth firms would be $\tau D r_u/(r_u\text{-}g)$, where r_u is the required return to unlevered equity and g is the constant growth rate.

[21]See Schauten & Tans (2009) for a derivation of the cost of tax for the government. Note: the higher the leverage, the lower G_l, the higher G_u - G_l (= PVTS).

discount rate for the tax shield.[22] Although Miles and Ezzel's (1980) method is more elegant, the differences in valuation are often minimal in practice.[23]

Figure 1
Pre-tax value of the firm

Figure 1 presents the expanded balance sheet of the unlevered and the levered firm with on the left hand side the pre-tax value of the firm and on the right hand side the present value of the tax payments to the government by the unlevered firm (G_u) and the levered firm (G_l), the market value of equity of the unlvered firm (E_u) and the levered firm (E_l) and the market value of debt of the levered firm (D).

Balance sheet of the unlevered firm

Pre-tax asset value	PV government claim (G_u)
	PV residual claim equityholders (E_u)
Total value (TV)	Total value (TV)

Balance sheet of the levered firm

Pre-tax asset value	PV government claim (G_l)
	PV residual claim equityholders (E_l)
	Debt (D)
Total value (TV)	Total value (TV)

Summary

By use of an example, we have shown in this paper that applying proposition II of MM (1963) can lead to incorrect values for projects with a finite life. The methods presented —the APV-method, the CFE-method and the WACC-method— then give different values for project X. When applying the CFE and WACC valuation methods, the cost of equity has to be determined correctly. If r_D is the discount rate for the tax shields, the equity holders' required return equals:

$$r_{E,t}=r_U+\frac{(D_t\text{-}PVTS_t)}{E_t}(r_U\text{-}r_D)$$

[22]The WACC$_{\text{after taxes}}$ then equals: $WACC = r_u - (\tau_c r_D D)/V_L$ (see Appendix B). If, at the beginning of each year, the project is 40% debt financed, the project value at t=0 equals 552,48. The amount of debt at t = 0 then equals 220,99 (40% of 552,48). The WACC$_{\text{before taxes}}$ is not directly applicable, because the CFCs cannot be determined directly.

[23]The WACC$_{\text{after taxes}}$ then equals: $WACC = r_u - (D/V_L)(r_D \tau_c (1+r_U)/(1+r_D))$. If at the beginning of each year, the project is 40% debt financed, the project value at t=0 equals 552.79. The amount of debt at t=0 then equals 221.12 (40% of 552.79). Note: if the firm follows a target debt ratio of 40% and r_D is used as the discount rate for the tax shield, the textbook WACC (see Appendix A) cannot be employed because for this project the PVTS at t=0 is not τ_c times the amount of D at t=0. If, anyhow, one wants to value the project using r_D as the discount rate, one should derive a WACC for each year using equation (6). If the project is 40% debt financed at the beginning of each year, the total project value equals € 553,13 at t = 0. This value is higher than Miles and Ezzell's since the discount rate is set to r_D for all years (which is lower than r_U)

and does not equal proposition II of MM:

$$r_E = r_U + \frac{D}{E}(1-\tau_c)(r_U - r_D)$$

This MM relation is based on the assumption that the value of tax savings at t=0 equals the tax rate times the amount of debt. This does not hold for project X, as a result of which MM II is not applicable.

References

Arzac, E.R. and L.R. Glosten (2005). A reconsideration of tax shield valuation. *European Financial Management* (11): 453-461.

Berk, J. and P. De Marzo (2011). *Corporate Finance*, 2nd edition, Boston: Prentice Hall.

Brealey, R.A., S.C. Myers and F. Allen (2008). *Principles of Corporate Finance*, 9th edition, New York: McGraw-Hill.

Ehrhart, M.C. and P.R. Daves (2002). Corporate valuation: the combined impact of growth and the tax shield of debt on the cost of capital and systematic risk. *Journal of Applied Finance* (12): 31-38.

Cooper, I.A. and K.G. Nyborg (2006). The value of tax shields IS equal to the present value of tax shields. *Journal of Financial Economics* (81): 215-225.

Fernández, P. (2004). The value of tax shields is NOT equal to the present value of tax shields *Journal of Financial Economics* (73): 145-165.

———— (2005). Reply to Comment on ‘The value of tax shields is NOT equal to the present value of tax shields. *The Quarterly Review of Economics and Finance* (45): 188-192.

Fieten, P., L. Kruschwitz, J. Laitenberger, A. Löffler, J. Tham, I. Vélez-Pareja and N. Wonder. (2005). Comment on The value of tax shields is NOT equal to the present value of tax shields. *The Quarterly Review of Economics and Finance* (45): 184-187.

Inselbag, I. and H. Kaufold (1997). Two DCF approaches for valuing companies under alternative financing strategies (and how to choose between them). *Journal of Applied Corporate Finance* 10(1): 114-122.

Kaplan, S. and R. Ruback (1995). The valuation of cash flow forecast: an empirical analysis. *Journal of Finance* (50): 1059-1093.

Lewellen, W.G. and D.R. Emmery (1986). Corporate debt management and the value of the firm. *Journal of Financial Quantitative Analysis* (21): 415-426.

Luehrman, T. (1997). Using APV: a better tool for valuing operations. *Harvard Business Review* (75): 145-154.

Miles, J.A. and J.R. Ezzell (1980). The weighted average cost of capital, perfect capital markets and project life: a clarification. *Journal of Financial and Quantitative Analysis* (15): 719-730.

Myers, S.C. (1974). Interactions of corporate financing and investment decisions, implications for capital budgeting. *Journal of Finance* (29): 1-25.

Modigliani, F. and M.H. Miller (1958). The cost of capital, corporation finance and the theory of investment. *American Economic Review* (48): 261-297.

——————— (1963). Corporate income taxes and the cost of capital: a correction, *American Economic Review* (53): 433-443.

Ruback, R.S. (2002). Capital Cash Flows: A Simple Approach to Valuing Risky Cash Flows. *Financial management* (Summer): 85-103.

Schauten, M.B.J. and B. Tans 2009, Cost of Capital of Government's Claims and the Present Value of Tax Shields. Available at SSRN.

Appendix A

A derivation for r_E with r_D as the appropriate discount rate for the tax shields

The required return by the equity and debt providers has to be equal to the return generated by the firm's (or the project's) assets:

$$V_{U,t}(r_U) + PVTS_t(r_{VV}) = D_t(r_D) + \left(r_{E,t}\right)$$

Substitute $V_{U,t} = E_t + D_t - PVTS_t$

$$r_U(E_t + D_t - PVTS_t) + PVTS_t(r_D) = D_t(r_D) + \left(r_{E,t}\right)E_t \qquad \Rightarrow$$

$$(r_{E,t}) = r_U(E_t) + r_U(D_t - PVTS_t) + PVTS_t(r_D) - D_t(r_D) \qquad \Rightarrow$$

$$(r_{E,t}) = r_U + \frac{r_U(D_t) - r_U(PVTS_t) + PVTS_t(r_D) - D_t(r_D)}{E_t} \qquad \Rightarrow$$

$$(r_{E,t}) = r_U + \frac{(D_t) - (PVTS_t)}{E_t}(r_u - r_D) \qquad \text{(A1) or (6)}$$

When $PVTS_t$ equals $\tau_c D$, (A1) can be written as:

$$(r_{E,t}) = r_U + \frac{(D_t) - (t_c D_t)}{E_t}(r_u - r_D) = r_U + (1 - t_c)\frac{D_t}{E_t}(r_u - r_D) \qquad \text{(MM II)}$$

This equation is consistent with proposition II of Miller and Modigliani (1963).

When inserting this 'MM-equation' in the equation that computes the WACC by taking the weighted average of r_D after taxes and r_E we find:

$$(WACC_t) = r_U\left(1 - t_C\left(\frac{D_t}{D_t + E_t}\right)\right)$$

This is the textbook WACC (after taxes).

Appendix B

A derivation for r_E with r_U as the appropriate discount rate for the tax shields

The required return by the equity and debt providers has to be equal to the return generated by the firm's (or the project's) assets:

$$V_{U,t}(r_U) + PVTS_t(r_U) = D_t(r_D) + E_t\left(r_{E,t}\right)$$

Substitute $V_{U,t} = E_t + D_t - PVTS_t$

$$r_U(E_t+D_t-PVTS_t)+PVTS_t(r_U)=D_t(r_D)+E_t\left(r_{E,t}\right) \qquad \Rightarrow$$

$$r_U E_t + r_U D_t = D_t(r_D)+E_t\left(r_{E,t}\right) \qquad \Rightarrow$$

$$(r_{E,t}) = r_U E_t + r_U D_t - r_D D_t \qquad \Rightarrow$$

$$(r_{E,t}) = r_U + \frac{D_t}{E_t}(r_u - r_D) \qquad \text{(B1)}$$

Note that this equation is consistent with proposition II of Miller and Modigliani (1958) in a perfect capital market.

When substituting this equation in the equation that computes the WACC by taking the weighted average of r_D after taxes and r_E we find:

$$WACC_t = r_U - \frac{D_t}{V_{L,t}}\tau_c r_D$$

Appendix C

A derivation for r_E with r_{TS} as the appropriate discount rate for the tax shields

The required return by the equity and debt providers has to be equal to the return generated by the firm's (or the project's) assets:

$$V_{U,t}(r_U) + PVTS_t(r_{ts}) = D_t(r_D) + \left(r_{E,t}\right)$$

Substitute $V_{U,t} = E_t + D_t - PVTS_t$

$$r_U(E_t+D_t-PVTS_t)+PVTS_t(r_{TS})=D_t(r_D)+(r_{E,t})E_t \qquad \Rightarrow$$

$$(r_{E,t})E_t = PVTS_t(r_{TS}) + r_U(E_t) + r_U(D_t)\text{-}r_U(PVTS_t)\text{-}D_t(r_D) \qquad \Rightarrow$$

$$(r_{E,t}) = r_U + \frac{PVTS(r_{TS}\text{-}r_U) + r_U(D_t)\text{-}D_t(r_D)}{E_t} \qquad \Rightarrow$$

$$(r_{E,t}) = r_U + \frac{PVTS(r_{TS}\text{-}r_U) + (r_U\text{-}r_D)(D_t)}{E_t} \qquad \Rightarrow$$

$$(r_{E,t}) = r_U + (r_U\text{-}r_D)\frac{D_t}{E_t}\text{-}(r_U\text{-}r_{TS})\frac{PVTS}{E_t} \qquad \text{(C1)}$$

If r_{TS} is equal to r_D then equation (C1) can be written as equation (A1):

$$(r_{E,t}) = r_U + (r_U\text{-}r_D)\frac{D_t}{E_t}\text{-}(r_U\text{-}r_D)\frac{PVTS}{E_t}$$

$$(r_{E,t}) = r_U + \frac{\left(D_t - PVTS_t\right)}{E_t}\left(r_U - r_D\right)$$

If r_{TS} is equal to r_U then equation (C1) can be written as equation (B2).

Lecture 1

Introduction to Corporate Finance
Financial Statements and Cash Flow

1.1 What Is Corporate Finance?

Corporate Finance addresses the following three questions:

1. What long-term investments should the firm choose?
2. How should the firm raise funds for the selected investments?
3. How should short-term assets be managed and financed?

Balance Sheet Model of the Firm

Total Value of Assets:

Total Firm Value to Investors:

Current Assets

Fixed Assets

1 Tangible

2 Intangible

Current Liabilities

Long-Term Debt

Shareholders' Equity

The Capital Budgeting Decision

Current Assets

Fixed Assets

1 Tangible

2 Intangible

What long-term investments should the firm choose?

Current Liabilities

Long-Term Debt

Shareholders' Equity

The Capital Structure Decision

Current Assets

Fixed Assets

1 Tangible

2 Intangible

How should the firm raise funds for the selected investments?

Current Liabilities

Long-Term Debt

Shareholders' Equity

Short-Term Asset Management

Current Assets

Fixed Assets

1 Tangible

2 Intangible

Net Working Capital

Current Liabilities

Long-Term Debt

Shareholders' Equity

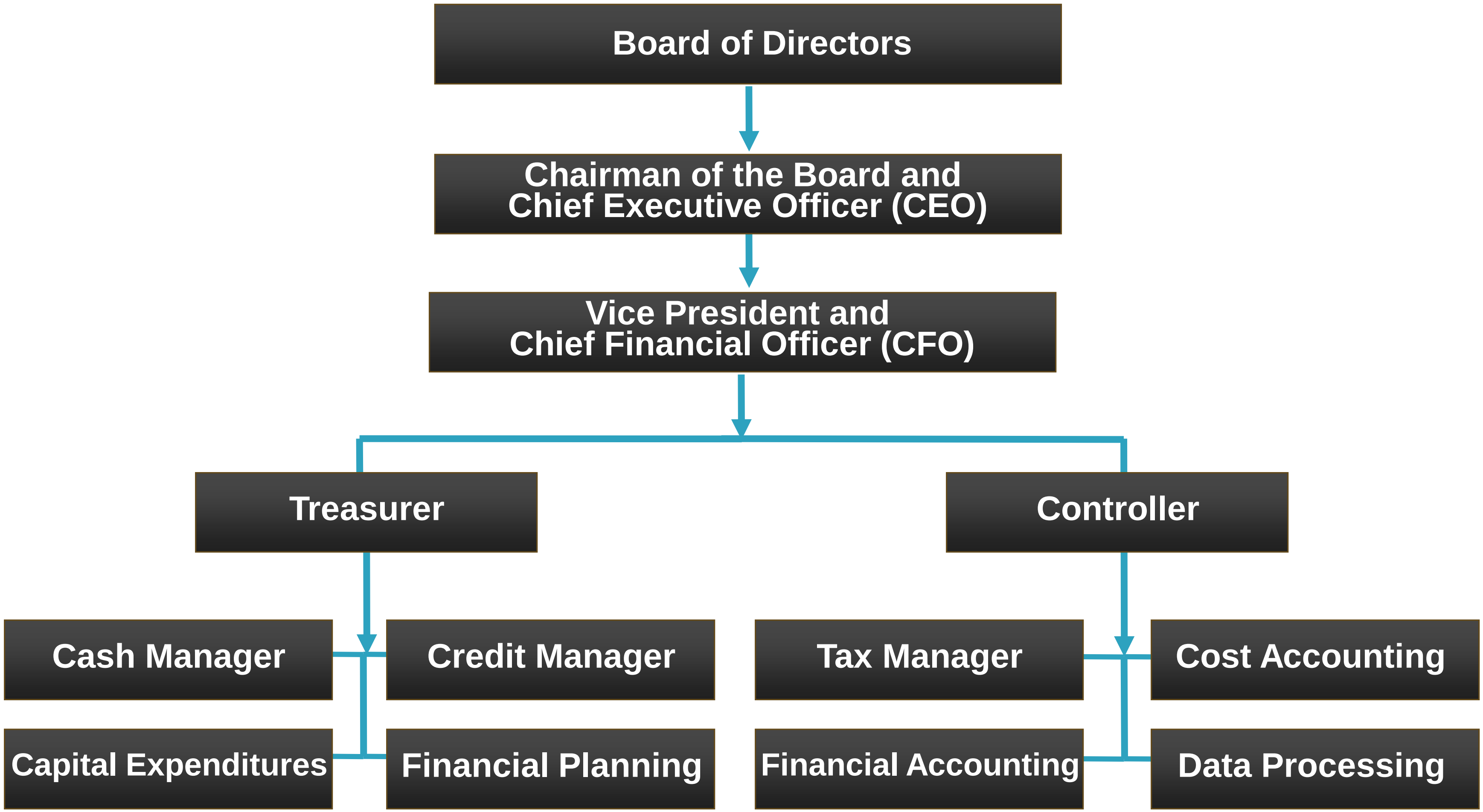
How should short-term assets be managed and financed?

The Financial Manager

The Financial Manager's primary goal is to increase the value of the firm by:

1. Selecting value creating projects
2. Making smart financing decisions

Hypothetical Organization Chart



1.2 The Corporate Firm

- The corporate form of business is the standard method for solving the problems encountered in raising large amounts of cash.
- However, businesses can take other forms.

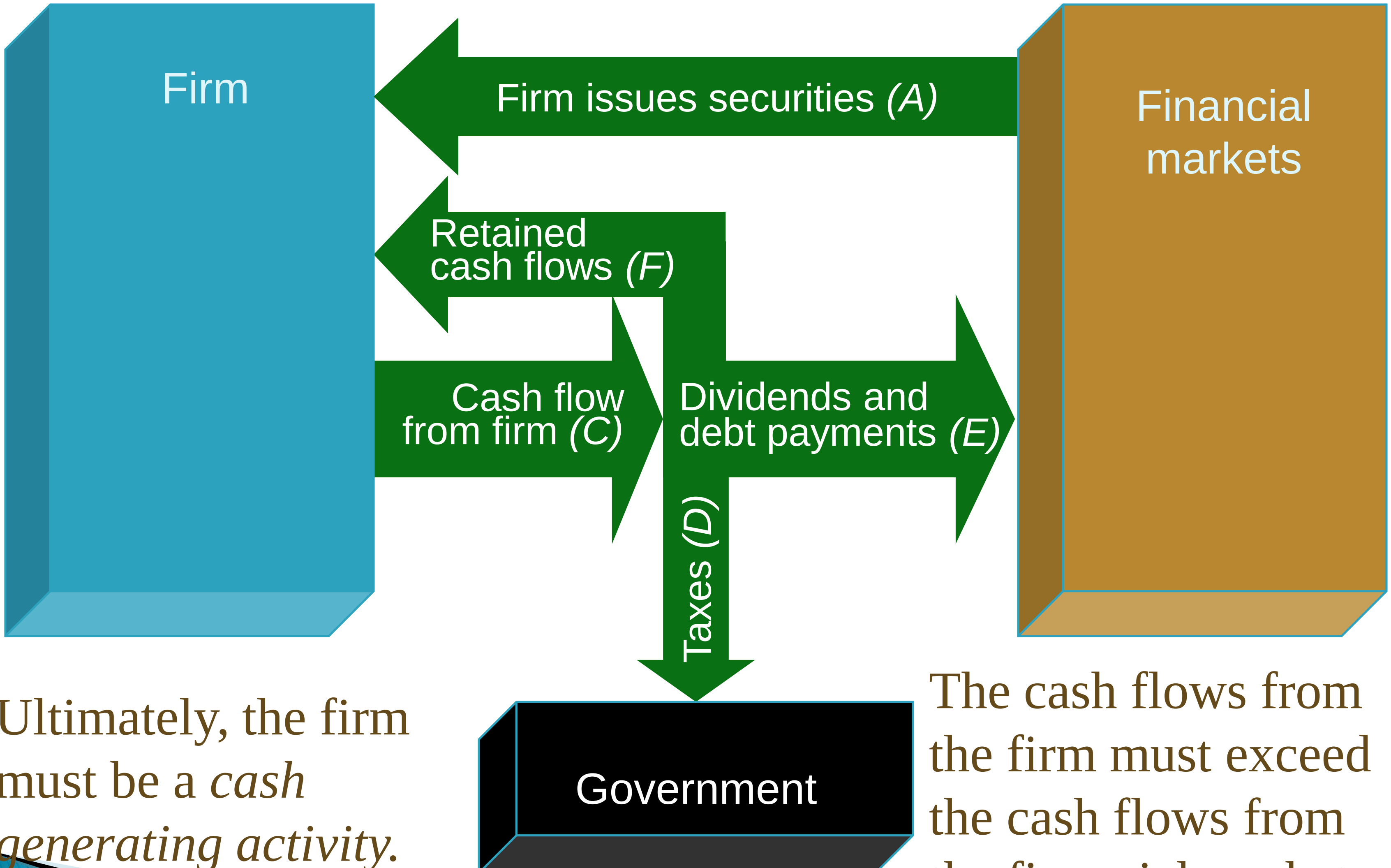
Forms of Business Organization

- The Sole Proprietorship
- The Partnership
  - General Partnership
  - Limited Partnership
- The Corporation

A Comparison

	Corporation	Partnership
Liquidity	Shares can be easily exchanged	Subject to substantial restrictions
Voting Rights	Usually each share gets one vote	General Partner is in charge; limited partners may have some voting rights
Taxation	Double	Partners pay taxes on distributions
Reinvestment and dividend payout	Broad latitude	All net cash flow is distributed to partners
Liability	Limited liability	General partners may have unlimited liability; limited partners enjoy limited liability
Continuity	Perpetual life	Limited life

1.3 The Importance of Cash Flow



Ultimately, the firm must be a *cash generating activity.*

The cash flows from the firm must exceed the cash flows from the financial markets.

1.4 The Goal of Financial Management

- What is the correct goal?
  - Maximize profit?
  - Minimize costs?
  - Maximize market share?
  - **Maximize shareholder wealth?**

1.5 The Agency Problem

- Agency relationship
  - Principal hires an agent to represent his/her interest
  - Stockholders (principals) hire managers (agents) to run the company
- Agency problem
  - Conflict of interest between principal and agent

Managerial Goals

- Managerial goals may be different from shareholder goals
  - Expensive perquisites
  - Survival
  - Independence
- Increased growth and size are not necessarily equivalent to increased shareholder wealth

Managing Managers

- Managerial compensation
  - Incentives can be used to align management and stockholder interests
  - The incentives need to be structured carefully to make sure that they achieve their intended goal
- Corporate control
  - The threat of a takeover may result in better management
- Other stakeholders

1.6 Regulation

- The Securities Act of 1933 and the Securities Exchange Act of 1934
  - Issuance of Securities (1933)
  - Creation of SEC and reporting requirements (1934)
- Sarbanes-Oxley (“Sarbox”)
  - Increased reporting requirements and responsibility of corporate directors

Financial Statements and Cash Flow

Sources of Information

- Annual reports
- *Wall Street Journal*
- Internet
  - NYSE (www.nyse.com)
  - NASDAQ (www.nasdaq.com)
  - Textbook (www.mhhe.com)
- SEC
  - EDGAR
  - 10K & 10Q reports

2.1 The Balance Sheet

- An accountant's snapshot of the firm's accounting value at a specific point in time
- The Balance Sheet Identity is:

$$\text{Assets} \equiv \text{Liabilities} + \text{Stockholder's Equity}$$

U.S. Composite Corporation Balance Sheet

	2015	2014
Current assets:		
Cash and equivalents	$140	$107
Accounts receivable	294	270
Inventories	269	280
Other	58	50
Total current assets	$761	$707
Fixed assets:		
Property, plant, and equipment	$1,423	$1,274
Less accumulated depreciation	(550)	(460)
Net property, plant, and equipment	873	814
Intangible assets and other	245	221
Total fixed assets	$1,118	$1,035
Total assets	$1,879	$1,742

The assets are listed in order by the length of time it would normally take a firm with ongoing operations to convert them into cash.

Clearly, cash is much more liquid than property, plant, and equipment.

Balance Sheet Analysis

- When analyzing a balance sheet, the Finance Manager should be aware of three concerns:
  1. Liquidity
  2. Debt versus equity
  3. Value versus cost

Liquidity

- Refers to the ease and quickness with which assets can be converted to cash—without a significant loss in value
- Current assets are the most liquid.
- Some fixed assets are intangible.
- The more liquid a firm's assets, the less likely the firm is to experience problems meeting short-term obligations.
- Liquid assets frequently have lower rates of return than fixed assets.

Debt versus Equity

- Creditors generally receive the first claim on the firm's cash flow.

- Shareholder's equity is the residual difference between assets and liabilities.

Value versus Cost

- Under Generally Accepted Accounting Principles (GAAP), audited financial statements of firms in the U.S. carry assets at cost.
- Market value is the price at which the assets, liabilities, and equity could actually be bought or sold, which is a completely different concept from historical cost.

2.2 The Income Statement

- Measures financial performance over a specific period of time

- The accounting definition of income is:

  Revenue – Expenses ≡ Income

U.S.C.C. Income Statement

The operations section of the income statement reports the firm's revenues and expenses from principal operations.

Total operating revenues	$2,262
Cost of goods sold	1,655
Selling, general, and administrative expenses	327
Depreciation	90
Operating income	$190
Other income	29
Earnings before interest and taxes	$219
Interest expense	49
Pretax income	$170
Taxes	84
Current: $71	
Deferred: $13	
Net income	$86
Addition to retained earnings	$43
Dividends:	$43

U.S.C.C. Income Statement

The non-operating section of the income statement includes all financing costs, such as interest expense.

Total operating revenues	$2,262
Cost of goods sold	1,655
Selling, general, and administrative expenses	327
Depreciation	90
Operating income	$190
Other income	29
Earnings before interest and taxes	$219
Interest expense	49
Pretax income	$170
Taxes	84
Current: $71	
Deferred: $13	
Net income	$86
Addition to retained earnings:	$43
Dividends:	$43

U.S.C.C. Income Statement

Usually a separate section reports the amount of taxes levied on income.

Total operating revenues	$2,262
Cost of goods sold	1,655
Selling, general, and administrative expenses	327
Depreciation	90
Operating income	$190
Other income	29
Earnings before interest and taxes	$219
Interest expense	49
Pretax income	$170
Taxes	84
Current: $71	
Deferred: $13	
Net income	$86
Addition to retained earnings:	$43
Dividends:	$43

U.S.C.C. Income Statement

Total operating revenues	$2,262
Cost of goods sold	1,655
Selling, general, and administrative expenses	327
Depreciation	90
Operating income	$190
Other income	29
Earnings before interest and taxes	$219
Interest expense	49
Pretax income	$170
Taxes	84
Current: $71	
Deferred: $13	
Net income	$86
Retained earnings:	$43
Dividends:	$43

Net income is the "bottom line."

Income Statement Analysis

- There are three things to keep in mind when analyzing an income statement:
  1. Generally Accepted Accounting Principles (GAAP)
  2. Non-Cash Items
  3. Time and Costs

GAAP

- The matching principle of GAAP dictates that revenues be matched with expenses.

- Thus, income is reported when it is earned, even though no cash flow may have occurred.

Non-Cash Items

- Depreciation is the most apparent. No firm ever writes a check for "depreciation."
- Another non-cash item is deferred taxes, which does not represent a cash flow.
- Thus, net income is not cash.

Time and Costs

- In the short-run, certain equipment, resources, and commitments of the firm are fixed, but the firm can vary such inputs as labor and raw materials.
- In the long-run, all inputs of production (and hence costs) are variable.
- Financial accountants do not distinguish between variable costs and fixed costs. Instead, accounting costs usually fit into a classification that distinguishes product costs from period costs.

2.3 Taxes

- The one thing we can rely on with taxes is that they are always changing
- Marginal vs. average tax rates
  - Marginal – the percentage paid on the next dollar earned
  - Average = the tax bill / taxable income
- Other taxes

2.4 Net Working Capital

- Net Working Capital ≡
  Current Assets – Current Liabilities

- NWC usually grows with the firm

U.S.C.C. Balance Sheet

$252m = $707- $455

	2015	2014
Current assets:		
Cash and equivalents	$140	$107
Accounts receivable	294	270
Inventories	269	280
Other	58	50
Total current assets	$761	$707

	2015	2014
Current Liabilities:		
Accounts payable	$486	$455
Total current liabilities	$486	$455

$275m = $761m- $486m

Here we see NWC grow to $275 million in 2015 from $252 million in 2014.

$23 million

This increase of $23 million is an investment of the firm.

2.5 Cash Flow of the Firm

- In finance, the most important item that can be extracted from financial statements is the actual cash flow of the firm.
- Since there is no magic in finance, it must be the case that the cash flow received from the firm's assets must equal the cash flows to the firm's creditors and stockholders.

$$CF(A) \equiv CF(B) + CF(S)$$

U.S.C.C. Financial Cash Flow

Cash Flow of the Firm	
Operating cash flow	$238
(Earnings before interest and taxes plus depreciation minus taxes)	
Capital spending	-173
(Acquisitions of fixed assets minus sales of fixed assets)	
Additions to net working capital	-23
Total	$42
Cash Flow of Investors in the Firm	
Debt	$36
(Interest plus retirement of debt minus long-term debt financing)	
Equity	6
(Dividends plus repurchase of equity minus new equity financing)	
Total	$42

Operating Cash Flow:

EBIT	$219
Depreciation	$90
Current Taxes	-$71
OCF	$238

U.S.C.C. Financial Cash Flow

Cash Flow of the Firm	
Operating cash flow	$238
(Earnings before interest and taxes plus depreciation minus taxes)	
Capital spending	-173
(Acquisitions of fixed assets minus sales of fixed assets)	
Additions to net working capital	-23
Total	$42

Cash Flow of Investors in the Firm	
Debt	$36
(Interest plus retirement of debt minus long-term debt financing)	
Equity	6
(Dividends plus repurchase of equity minus new equity financing)	
Total	$42

Capital Spending

Purchase of fixed assets	$198
Sales of fixed assets	-$25
Capital Spending	$173

U.S.C.C. Financial Cash Flow

Cash Flow of the Firm	
Operating cash flow	$238
(Earnings before interest and taxes plus depreciation minus taxes)	
Capital spending	-173
(Acquisitions of fixed assets minus sales of fixed assets)	
Additions to net working capital	-23
Total	$42
Cash Flow of Investors in the Firm	
Debt	$36
(Interest plus retirement of debt minus long-term debt financing)	
Equity	6
(Dividends plus repurchase of equity minus new equity financing)	
Total	$42

NWC grew from $275 million in 2015 from $252 million in 2014.

This increase of $23 million is the addition to NWC.

U.S.C.C. Financial Cash Flow

Cash Flow of the Firm	
Operating cash flow	$238
(Earnings before interest and taxes plus depreciation minus taxes)	
Capital spending	-173
(Acquisitions of fixed assets minus sales of fixed assets)	
Additions to net working capital	-23
Total	$42
Cash Flow of Investors in the Firm	
Debt	$36
(Interest plus retirement of debt minus long-term debt financing)	
Equity	6
(Dividends plus repurchase of equity minus new equity financing)	
Total	$42

U.S.C.C. Financial Cash Flow

Cash Flow of the Firm	
Operating cash flow	$238
(Earnings before interest and taxes plus depreciation minus taxes)	
Capital spending	-173
(Acquisitions of fixed assets minus sales of fixed assets)	
Additions to net working capital	-23
Total	$42
Cash Flow of Investors in the Firm	
Debt	$36
(Interest plus retirement of debt minus long-term debt financing)	
Equity	6
(Dividends plus repurchase of equity minus new equity financing)	
Total	$42

<u>Cash Flow to Creditors</u>	
Interest	$49
Retirement of debt	73
Debt service	122
Proceeds from new debt sales	-86
Total	$36

U.S.C.C. Financial Cash Flow

Cash Flow of the Firm	
Operating cash flow	$238
(Earnings before interest and taxes plus depreciation minus taxes)	
Capital spending	-173
(Acquisitions of fixed assets minus sales of fixed assets)	
Additions to net working capital	-23
Total	$42
Cash Flow of Investors in the Firm	
Debt	$36
(Interest plus retirement of debt minus long-term debt financing)	
Equity	6
(Dividends plus repurchase of equity minus new equity financing)	
Total	$42

Cash Flow to Stockholders	
Dividends	$43
Repurchase of stock	6
Cash to Stockholders	49
Proceeds from new stock issue	-43
Total	$6

U.S.C.C. Financial Cash Flow

Cash Flow of the Firm	
Operating cash flow	$238
(Earnings before interest and taxes plus depreciation minus taxes)	
Capital spending	-173
(Acquisitions of fixed assets minus sales of fixed assets)	
Additions to net working capital	-23
Total	$42
Cash Flow of Investors in the Firm	
Debt	$36
(Interest plus retirement of debt minus long-term debt financing)	
Equity	6
(Dividends plus repurchase of equity minus new equity financing)	
Total	$42

The cash flow received from the firm's assets must equal the cash flows to the firm's creditors and stockholders:

$$CF(A) \equiv CF(B) + CF(S)$$

2.5 The Statement of Cash Flows

- There is an official accounting statement called the statement of cash flows.
- This helps explain the change in accounting cash, which for U.S. Composite is $33 million in 2010.
- The three components of the statement of cash flows are:
  - Cash flow from operating activities
  - Cash flow from investing activities
  - Cash flow from financing activities

U.S.C.C. Cash Flow from Operations

To calculate cash flow from operations, start with net income, add back non-cash items like depreciation and adjust for changes in current assets and liabilities (other than cash).

Operations	
Net Income	$86
Depreciation	90
Deferred Taxes	13
Changes in Assets and Liabilities	
Accounts Receivable	-24
Inventories	11
Accounts Payable	31
Cash Flow from Operating Activities	$207

U.S.C.C. Cash Flow from Investing

Cash flow from investing activities involves changes in capital assets: acquisition of fixed assets and sales of fixed assets (*i.e.*, net capital expenditures).

Acquisition of fixed assets	-$198
Sales of fixed assets	25
Total Cash Flow from Investing Activities	-$173

U.S.C.C. Cash Flow from Financing

Cash flows to and from creditors and owners include changes in equity and debt.

Retirement of debt (includes notes)	-$73
Proceeds from long-term debt sales	86
Dividends	-43
Repurchase of stock	-6
Proceeds from new stock issue	43
Total Cash Flow from Financing	$7

U.S.C.C. Statement of Cash Flows

The statement of cash flows is the addition of cash flows from operations, investing, and financing.

Operations	
Net Income	$86
Depreciation	90
Deferred Taxes	13
Changes in Assets and Liabilities	
Accounts Receivable	-24
Inventories	11
Accounts Payable	31
Total Cash Flow from Operations	$207
Investing Activities	
Acquisition of fixed assets	-$198
Sales of fixed assets	25
Total Cash Flow from Investing Activities	-$173
Financing Activities	
Retirement of debt (includes notes)	-$73
Proceeds from long-term debt sales	86
Dividends	-43
Repurchase of stock	-6
Proceeds from new stock issue	43
Total Cash Flow from Financing	$7
Change in Cash (on the balance sheet)	$41

2.7 Cash Flow Management

- Earnings can be manipulated using subjective decisions required under GAAP
- Total cash flow is more objective, but the underlying components may also be "managed"
  - Moving cash flow from the investing section to the operating section may make the firm's business appear more stable

Lecture 10

Capital Structure: Basic Concepts

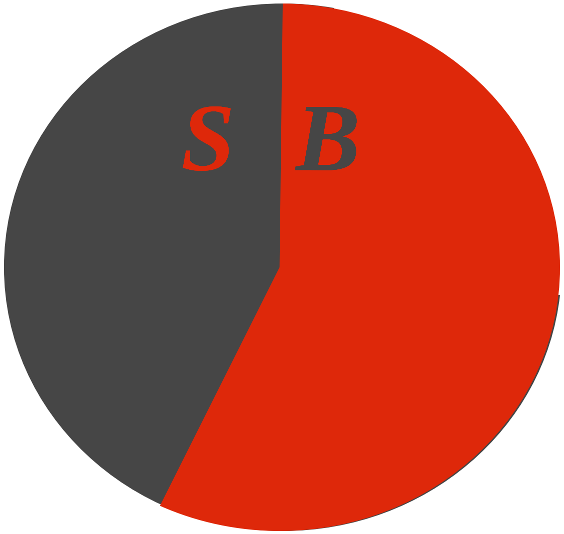
Key Concepts and Skills

- Understand the effect of financial leverage (i.e., capital structure) on firm earnings
- Understand homemade leverage
- Understand capital structure theories with and without taxes
- Be able to compute the value of the unlevered and levered firm

16.1 Capital Structure and the Pie

- The value of a firm is defined to be the sum of the value of the firm's debt and the firm's equity.
  $V = B + S$

• If the goal of the firm's management is to make the firm as valuable as possible, then the firm should pick the debt-equity ratio that makes the pie as big as possible.



Value of the Firm

Stockholder Interests

There are two important questions:

1. Why should the stockholders care about maximizing *firm* value? Perhaps they should be interested in strategies that maximize *shareholder* value.
2. What is the ratio of debt-to-equity that maximizes the shareholder's value?

As it turns out, changes in capital structure only benefit the stockholders if the value of the firm increases.

Example: JJ Sprint Company

- No debt, 100 shares selling at $10 each, so total firm value is $1,000.
- Consider a plan to borrow $500 and pay the proceeds to shareholders as an extra cash dividend of $5 per share.
- Suppose that the value of the firm increases to $1,250 as a result after payment of dividends - $500 debt and $750 equity.
- The net gain to shareholders is $500 + (750-1000) = $250.
- This is the increase in the value of the firm.

16.3 Financial Leverage, EPS, and ROE

Consider an all-equity firm that is contemplating going into debt. (Maybe some of the original shareholders want to cash out.)

	Current	Proposed
Assets	$20,000	$20,000
Debt	$0	$8,000
Equity	$20,000	$12,000
Debt/Equity ratio	0.00	2/3
Interest rate	n/a	8%
Shares outstanding	400	240
Share price	$50	$50

EPS and ROE Under Current Structure

	Recession	Expected	Expansion
EBIT	$1,000	$2,000	$3,000
Interest	0	0	0
Net income	$1,000	$2,000	$3,000
EPS	$2.50	$5.00	$7.50
ROA	5%	10%	15%
ROE	5%	10%	15%

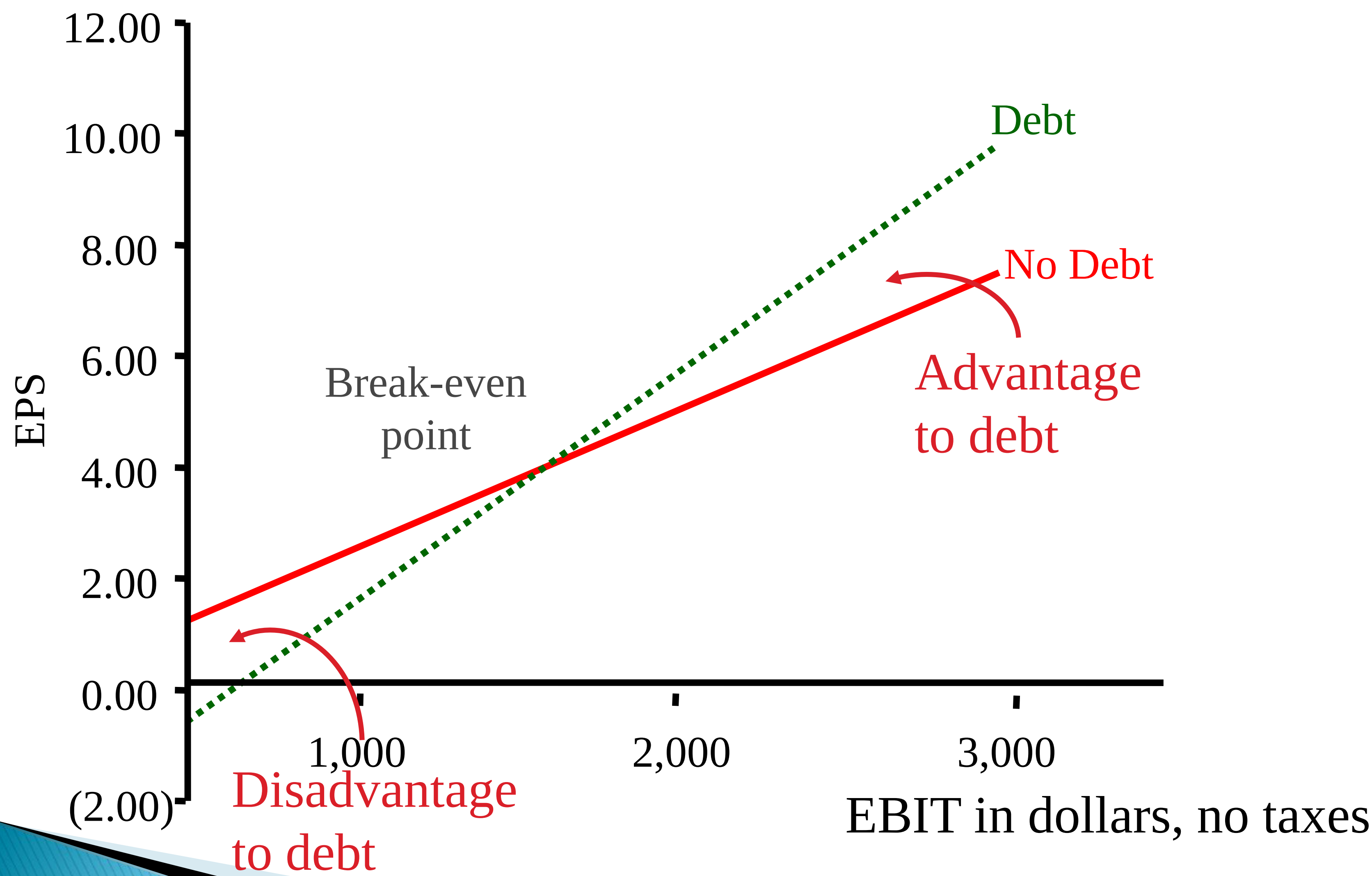
Current Shares Outstanding = 400 shares

EPS and ROE Under Proposed Structure

	Recession	Expected	Expansion
EBIT	$1,000	$2,000	$3,000
Interest	640	640	640
Net income	$360	$1,360	$2,360
EPS	$1.50	$5.67	$9.83
ROA	1.8%	6.8%	11.8%
ROE	3.0%	11.3%	19.7%

Proposed Shares Outstanding = 240 shares

Financial Leverage and EPS



Break Even

$$\frac{EBIT}{400} = \frac{EBIT - 640}{240}$$

$$EBIT = 1600$$

Assumptions of the Modigliani & Miller (M&M) Model

- Homogeneous Expectations
- Homogeneous Business Risk Classes
- Perpetual Cash Flows
- Perfect Capital Markets:
  - Perfect competition
  - Firms and investors can borrow/lend at the same rate
  - Equal access to all relevant information
  - No transaction costs
  - No taxes

Homemade Leverage: An Example

	Recession	Expected	Expansion
EPS of Unlevered Firm	*$2.50*	*$5.00*	*$7.50*
Earnings for 40 shares	$100	$200	$300
Less interest on $800 (8%)	$64	$64	$64
Net Profits	$36	$136	$236
ROE (Net Profits / $1,200)	3.0%	11.3%	19.7%

We are buying 40 shares of a $50 stock, using $800 in margin.
We get the same ROE as if we bought into a levered firm.

Our personal debt-equity ratio is: $\frac{B}{S} = \frac{\$800}{\$1{,}200} = {}^{2}\!/_{3}$

Homemade (Un)Leverage: An Example

	Recession	Expected	Expansion
EPS of Levered Firm	*$1.50*	*$5.67*	*$9.83*
Earnings for 24 shares	$36	$136	$236
Plus interest on $800(8%)	$64	$64	$64
Net Profits	$100	$200	$300
ROE (Net Profits/$2,000)	5%	10%	15%

Buying 24 shares of an otherwise identical levered firm along with some of the firm's debt gets us to the ROE of the unlevered firm.

This is the fundamental insight of M&M

MM Proposition I (No Taxes)

- We can create a levered or unlevered position by adjusting the trading in our own account.
- This homemade leverage suggests that capital structure is irrelevant in determining the value of the firm:

$$V_L = V_U$$

The value of the levered firm is the same as the value of the unlevered firm

Implication of MM Proposition 1

- R_{WACC} is constant for a given firm, regardless of the capital structure
- Previous example, expected situation:
- Unlevered case WACC = R_0 = 10%
- Levered case WACC

  = (3/5) x 11.33% + (2/5) x 8% = 10%

16.4 MM Proposition II (No Taxes)

- Proposition II
  - Leverage increases the risk and return to stockholders

$$R_s = R_0 + (B / S_L)\,(R_0 - R_B)$$

R_B is the interest rate (cost of debt)

R_s is the return on (levered) equity (cost of equity)

R_0 is the return on unlevered equity (cost of capital)

B is the value of debt

S_L is the value of levered equity

MM Proposition II (No Taxes)

The derivation is straightforward:

$$R_{WACC} = \frac{B}{B+S} \times R_B + \frac{S}{B+S} \times R_S$$ Then set $R_{WACC} = R_0$

$$\frac{B}{B+S} \times R_B + \frac{S}{B+S} \times R_S = R_0$$ multiply both sides by $\frac{B+S}{S}$

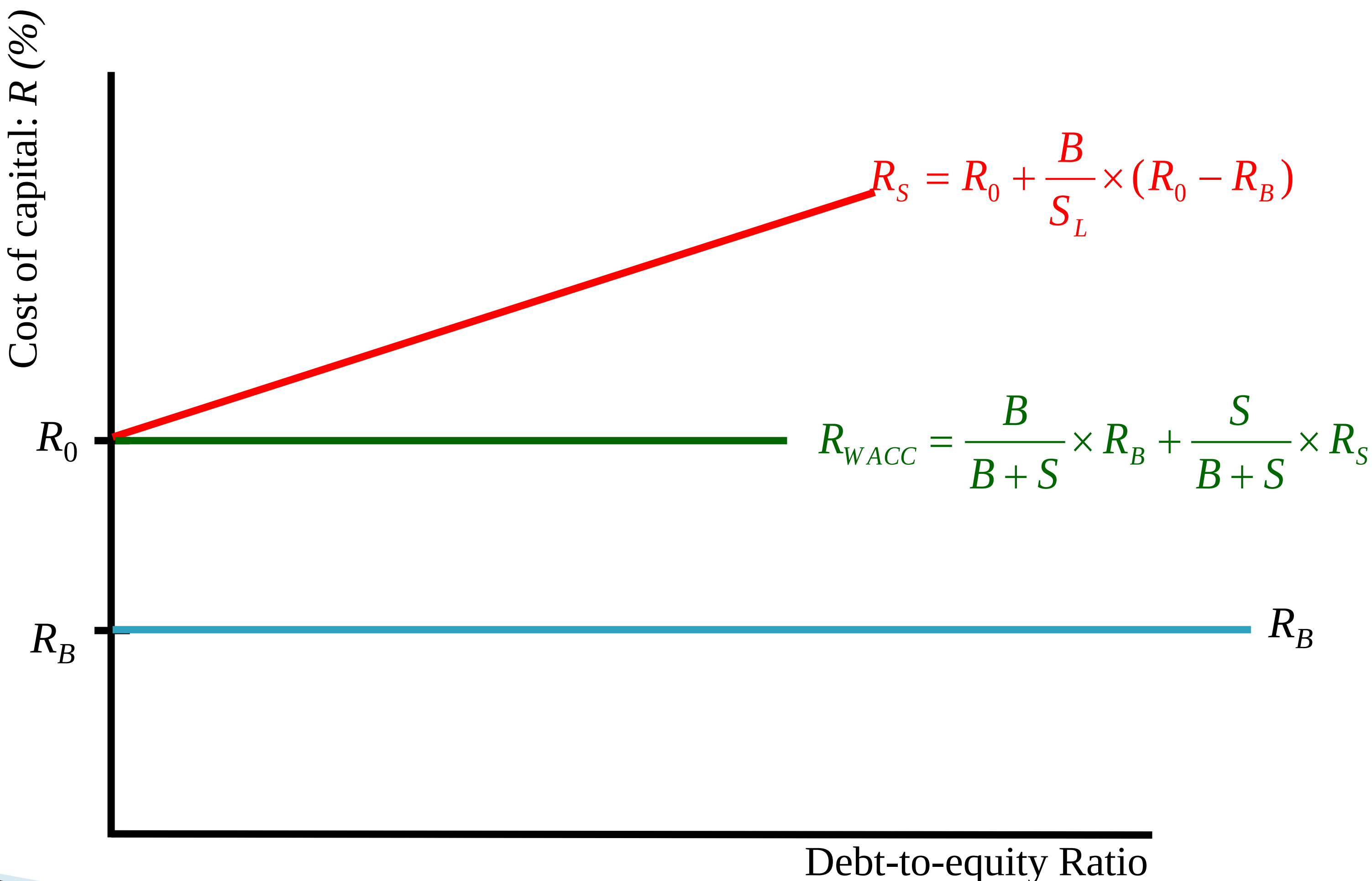
$$\cancel{\frac{B+S}{S}} \times \frac{B}{\cancel{B+S}} \times R_B + \cancel{\frac{B+S}{S}} \times \cancel{\frac{S}{B+S}} \times R_S = \frac{B+S}{S} R_0$$

$$\frac{B}{S} \times R_B + R_S = \frac{B+S}{S} R_0$$

$$\frac{B}{S} \times R_B + R_S = \frac{B}{S} R_0 + R_0$$

$$R_S = R_0 + \frac{B}{S}(R_0 - R_B)$$

MM Proposition II (No Taxes)



16.5 MM Propositions I & II (With Taxes)

- Proposition I (with Corporate Taxes)
  - Firm value increases with leverage

$$V_L = V_U + T_C B$$

- Proposition II (with Corporate Taxes)
  - Some of the increase in equity risk and return is offset by the interest tax shield

$$R_S = R_0 + (B/S) \times (1-T_C) \times (R_0 - R_B)$$

R_B is the interest rate (cost of debt)

R_S is the return on equity (cost of equity)

R_0 is the return on unlevered equity (cost of capital)

B is the value of debt

S is the value of levered equity

MM Proposition I (With Taxes)

The total cash flow to all stakeholders is

$$(EBIT - R_B B) \times (1 - T_C) + R_B B$$

The present value of this stream of cash flows is V_L

Clearly $(EBIT - R_B B) \times (1 - T_C) + R_B B =$

$$= EBIT \times (1 - T_C) - R_B B \times (1 - T_C) + R_B B$$

$$= EBIT \times (1 - T_C) - \cancel{R_B B} + R_B B T_C + \cancel{R_B B}$$

The present value of the first term is V_U

The present value of the second term is $T_C B$ (value of tax shield)

$$\therefore \; V_L = V_U + T_C B$$

MM Proposition II (With Taxes)

Start with M&M Proposition I with taxes: $V_L = V_U + T_C B$

Since $V_L = S + B \;\Rightarrow S + B = V_U + T_C B$

$$V_U = S + B(1 - T_C)$$

The cash flows from each side of the balance sheet must equal:

$$SR_S + BR_B = V_U R_0 + T_C BR_B$$

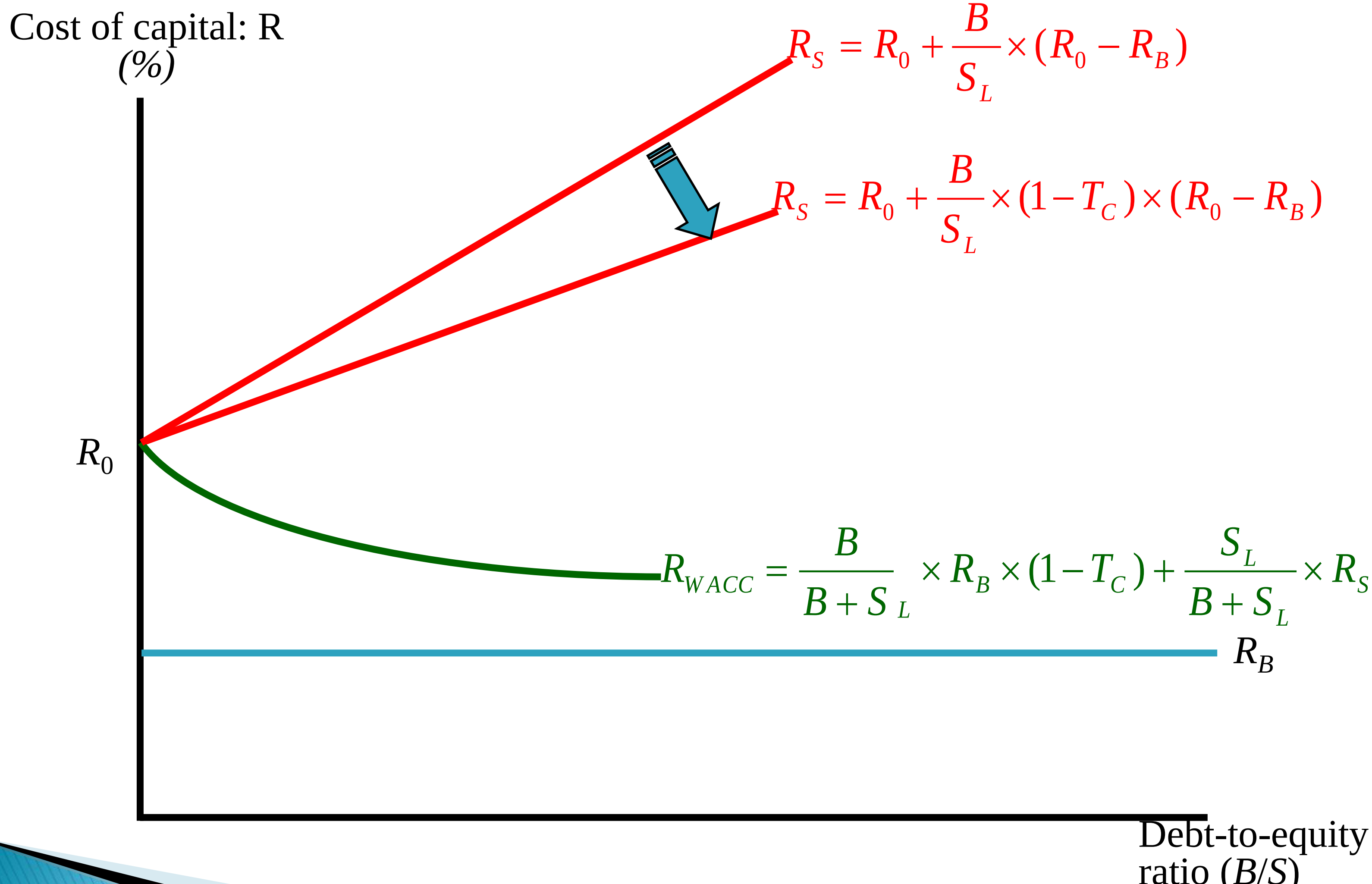
$$SR_S + BR_B = [S + B(1 - T_C)]R_0 + T_C R_B B$$

Divide both sides by S

$$R_S + \frac{B}{S}R_B = [1 + \frac{B}{S}(1 - T_C)]R_0 + \frac{B}{S}T_C R_B$$

Which quickly reduces to $R_S = R_0 + \dfrac{B}{S} \times (1 - T_C) \times (R_0 - R_B)$

The Effect of Financial Leverage



Total Cash Flow to Investors

All Equity

	Recession	Expected	Expansion
EBIT	$1,000	$2,000	$3,000
Interest	0	0	0
EBT	$1,000	$2,000	$3,000
Taxes (Tc = 35%)	$350	$700	$1,050
Total Cash Flow to S/H	$650	$1,300	$1,950

Levered

	Recession	Expected	Expansion
EBIT	$1,000	$2,000	$3,000
Interest ($800 @ 8%)	640	640	640
EBT	$360	$1,360	$2,360
Taxes (Tc = 35%)	$126	$476	$826
Total Cash Flow	$234+640	$884+$640	$1,534+$640
(to both S/H & B/H):	$874	$1,524	$2,174
$EBIT(1-Tc)+T_C R_B B$	$650+$224	$1,300+$224	$1,950+$224
	$874	$1,524	$2,174

Total Cash Flow to Investors

The levered firm pays less in taxes than does the all-equity firm.

Thus, the sum of the debt plus the equity of the levered firm is greater than the equity of the unlevered firm.

This is how cutting the pie differently can make the pie “larger.”
-the government takes a smaller slice of the pie!

Summary: No Taxes

- In a world of no taxes, the value of the firm is unaffected by capital structure.
- This is M&M Proposition I:

$$V_L = V_U$$

- Proposition I holds because shareholders can achieve any pattern of payouts they desire with homemade leverage.
- In a world of no taxes, M&M Proposition II states that leverage increases the risk and return to stockholders.

$$R_S = R_0 + \frac{B}{S_L} \times (R_0 - R_B)$$

Summary: Taxes

- In a world of taxes, but no bankruptcy costs, the value of the firm increases with leverage.
- This is M&M Proposition I:

$$V_L = V_U + T_C B$$

- Proposition I holds because shareholders can achieve any pattern of payouts they desire with homemade leverage.
- In a world of taxes, M&M Proposition II states that leverage increases the risk and return to stockholders.

$$R_S = R_0 + \frac{B}{S_L} \times (1 - T_C) \times (R_0 - R_B)$$

Lecture 11

Capital Structure: Limits to the Use of Debt

Key Concepts and Skills

- Define the costs associated with bankruptcy
- Understand the theories that address the level of debt a firm carries
  - Tradeoff
  - Signaling
  - Agency Cost
  - Pecking Order
- Know real world factors that affect the debt to equity ratio

17.1 Costs of Financial Distress

- Bankruptcy risk versus bankruptcy cost
- The possibility of bankruptcy has a negative effect on the value of the firm.
- However, it is not the risk of bankruptcy itself that lowers value.
- Rather, it is the costs associated with bankruptcy.
- It is the stockholders who bear these costs.

17.2 Description of Financial Distress Costs

- Direct Costs
  - Legal and administrative costs
- Indirect Costs
  - Impaired ability to conduct business (e.g., lost sales)
- Agency Costs
  - Selfish Strategy 1: Incentive to take large risks
  - Selfish Strategy 2: Incentive toward underinvestment
  - Selfish Strategy 3: Milking the property

Example: Company in Distress

Assets	BV	MV	Liabilities	BV	MV
Cash	$200	$200	LT bonds	$300	$200
Fixed Asset	$400	$0	Equity	$300	$0
Total	$600	$200	Total	$600	$200

What happens if the firm is liquidated today?

The bondholders get $200; the shareholders get nothing.

Selfish Strategy 1: Take Risks

The Gamble	Probability	Payoff
Win Big	10%	$1,000
Lose Big	90%	$0

Cost of investment is $200 (all the firm's cash)

Required return is 50%

Expected CF from the Gamble = $1000 × 0.10 + $0 = $100

$$NPV = -\$200 + \frac{\$100}{(1.50)}$$

$$NPV = -\$133$$

Selfish Strategy 1: Take Risks

- Expected CF from the Gamble
  - To Bondholders = $300 × 0.10 + $0 = $30
  - To Stockholders = ($1000 – $300) × 0.10 + $0 = $70
- PV of Bonds Without the Gamble = $200
- PV of Stocks Without the Gamble = $0

- PV of Bonds With the Gamble: $\$20 = \dfrac{\$30}{(1.50)}$
- PV of Stocks With the Gamble: $\$47 = \dfrac{\$70}{(1.50)}$

Selfish Strategy 2: Underinvestment

- Consider a government-sponsored project that guarantees \$350 in one period.
- Cost of investment is \$300 (the firm only has \$200 now), so the stockholders will have to supply an additional \$100 to finance the project.
- Required return is 10%.

$$\text{NPV} = -\$300 + \frac{\$350}{(1.10)}$$

$$\text{NPV} = \$18.18$$

- Should we accept or reject?

Selfish Strategy 2: Underinvestment

Expected CF from the government sponsored project:

To Bondholder = \$300

To Stockholder = (\$350 – \$300) = \$50

PV of Bonds Without the Project = \$200

PV of Stocks Without the Project = \$0

PV of Bonds With the Project: $\$272.73 = \dfrac{\$300}{(1.10)}$

PV of Stocks With the Project: $-\$54.55 = \dfrac{\$50}{(1.10)} - \$100$

Selfish Strategy 3: Milking the Property

- Liquidating dividends
  - Suppose our firm paid out a $200 dividend to the shareholders. This leaves the firm insolvent, with nothing for the bondholders, but plenty for the former shareholders.
  - Such tactics often violate bond indentures.
- Increase perquisites to shareholders and/or management

17.3 Can Costs of Debt Be Reduced?

- Protective Covenants
  - Limitations on dividends
  - Borrower may not pledge assets to other lenders
  - May not merge with another firm
  - May not sell or lease major assets without approval of lender
  - May not issue additional long-term debt
  - Agree to maintain minimum level of working capital
  - Provide periodic financial statements to lender
- Debt Consolidation:
  - If we minimize the number of parties, contracting costs fall.

17.4 Tax Effects and Financial Distress

- There is a trade-off between the tax advantage of debt and the costs of financial distress.
- It is difficult to express this with a precise and rigorous formula.

Tax Effects and Financial Distress

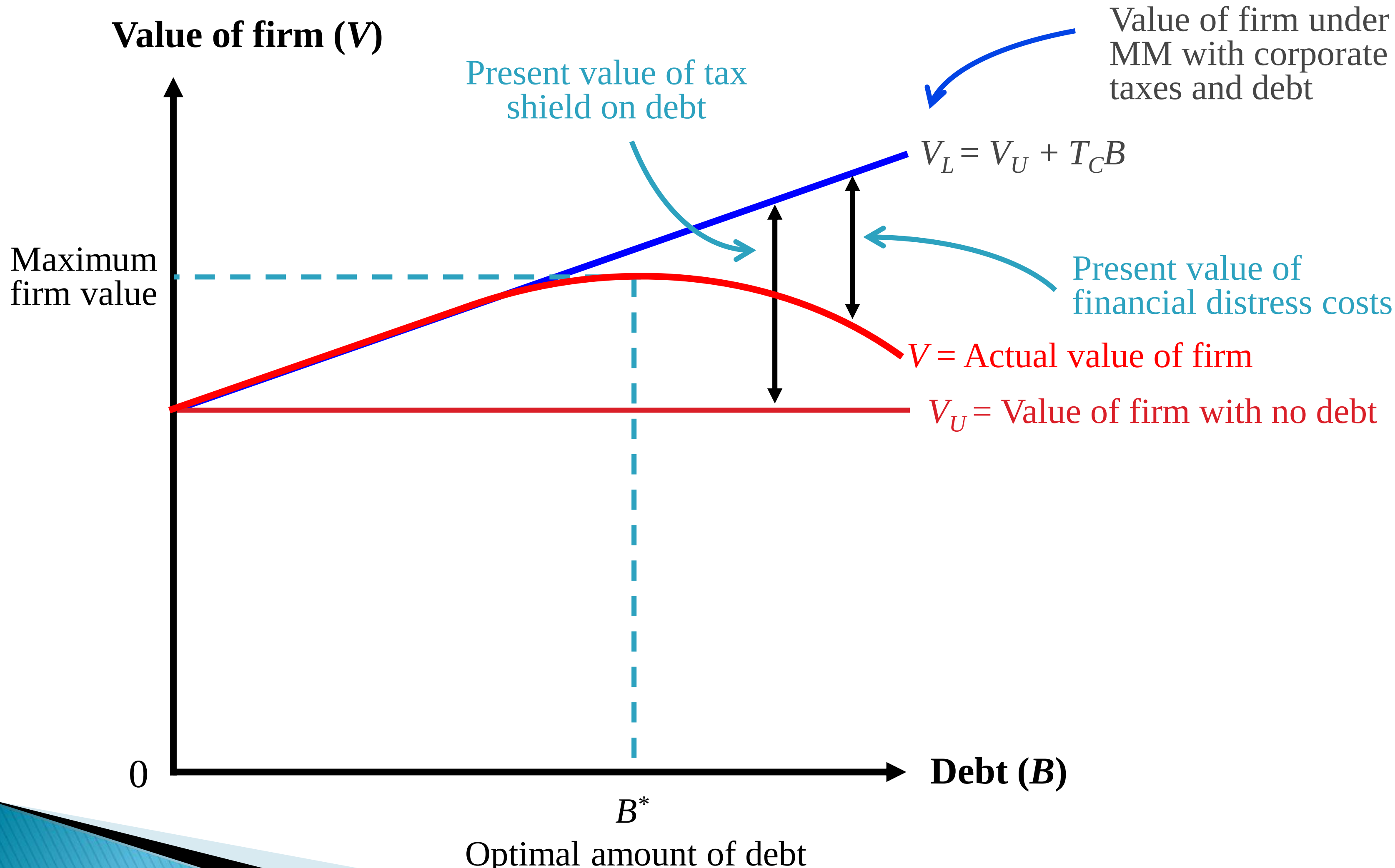
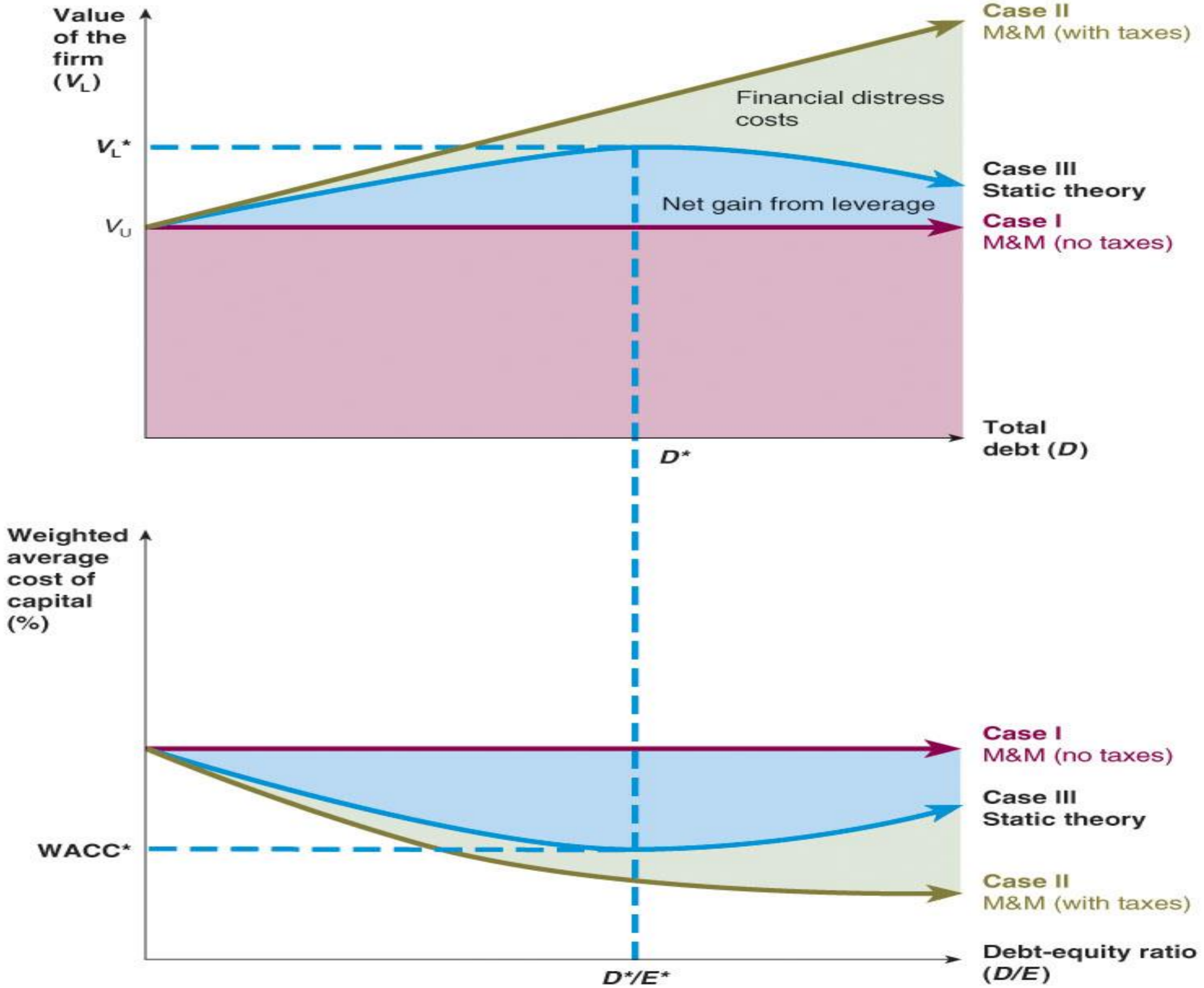


FIGURE 13.6

The capital structure question



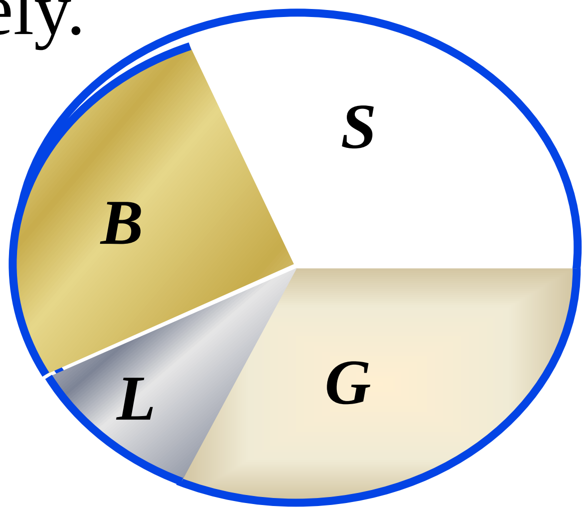
Case I
With no taxes or bankruptcy costs, the value of the firm and its weighted average cost of capital are not affected by capital structures.

Case II
With corporate taxes and no bankruptcy costs, the value of the firm increases and the weighted average cost of capital decreases as the amount of debt goes up.

Case III
With corporate taxes and bankruptcy costs, the value of the firm, V_L, reaches a maximum at D*, the optimal amount of borrowing. At the same time, the weighted average cost of capital, WACC, is minimized at D*/E*.

The Pie Model Revisited

- Taxes and bankruptcy costs can be viewed as just another claim on the cash flows of the firm.
- Let G and L stand for payments to the government and bankruptcy lawyers, respectively.
- $V_T = S + B + G + L$



- *The essence of the M&M intuition is that V_T depends on the cash flow of the firm; capital structure just slices the pie.*

17.5 Signaling

- The firm’s capital structure is optimized where the marginal subsidy to debt equals the marginal cost.
- Investors view debt as a signal of firm value.
  - Firms with low anticipated profits will take on a low level of debt.
  - Firms with high anticipated profits will take on a high level of debt.
- A manager that takes on more debt than is optimal in order to fool investors will pay the cost in the long run.

17.6 Agency Cost of Equity

- An individual will work harder for a firm if he is one of the owners than if he is one of the "hired help."
- While managers may have motive to partake in perquisites, they also need opportunity. Free cash flow provides this opportunity.
- The *free cash flow hypothesis* says that an increase in dividends should benefit the stockholders by reducing the ability of managers to pursue wasteful activities.
- The *free cash flow hypothesis* also argues that an increase in debt will reduce the ability of managers to pursue wasteful activities more effectively than dividend increases.

17.7 The Pecking-Order Theory

- Theory stating that firms prefer to issue debt rather than equity if internal financing is insufficient.
  - Rule 1
    - Use internal financing first
  - Rule 2
    - Issue debt next, new equity last
- The pecking-order theory is at odds with the tradeoff theory (financial distress costs vs tax benefits of debt):
  - There is no target D/E ratio
  - Profitable firms use less debt
  - Companies like financial slack

17.8 Personal Taxes

- Individuals, in addition to the corporation, must pay taxes. Thus, personal taxes must be considered in determining the optimal capital structure.

Personal Taxes

- Dividends face double taxation (firm and shareholder), which suggests a stockholder receives the net amount:
  - $(1 - T_C) \times (1 - T_S)$
- Interest payments are only taxed at the individual level since they are tax deductible by the corporation, so the bondholder receives:
  - $(1 - T_B)$

Personal Taxes

- If $T_S = T_B$ then the firm should be financed primarily by debt (avoiding double tax).
- The firm is indifferent between debt and equity when:

$$(1\text{-}T_C) \times (1\text{-}T_S) = (1\text{-}T_B)$$

17.9 How Firms Establish Capital Structure

- Most corporations have low Debt-Asset ratios.
- Changes in financial leverage affect firm value.
    - Stock price increases with leverage and vice-versa; this is consistent with M&M with taxes.
    - Another interpretation is that firms signal good news when they lever up.
- There are differences in capital structure across industries and even through time.
- There is evidence that firms behave as if they had a target Debt-Equity ratio.

Factors in Target D/E Ratio

- Taxes
  - Since interest is tax deductible, highly profitable firms should use more debt (i.e., greater tax benefit).
- Types of Assets
  - The costs of financial distress depend on the types of assets the firm has.
- Uncertainty of Operating Income
  - Even without debt, firms with uncertain operating income have a high probability of experiencing financial distress.

Lecture 12

Valuation and Capital Budgeting for the Levered Firm

Key Concepts and Skills

- Understand the effects of leverage on the value created by a project
- Be able to apply Adjusted Present Value (APV), the Flows to Equity (FTE) approach, and the WACC method for valuing projects with leverage

18.1 Adjusted Present Value Approach

$$APV = NPV + NPVF$$

- The value of a project to the firm can be thought of as the value of the project to an unlevered firm (*NPV*) plus the present value of the financing side effects (*NPVF*).
- There are four side effects of financing:
  - The Tax Subsidy to Debt
  - The Costs of Issuing New Securities
  - The Costs of Financial Distress
  - Subsidies to Debt Financing

APV Example

Consider a project of the Pearson Company. The timing and size of the incremental after-tax cash flows for an all-equity firm are:

–\$1,000	\$125	\$250	\$375	\$500
0	*1*	*2*	*3*	*4*

The unlevered cost of equity is R_0 = 10%:

$$NPV_{10\%} = -\$1{,}000 + \frac{\$125}{(1.10)} + \frac{\$250}{(1.10)^2} + \frac{\$375}{(1.10)^3} + \frac{\$500}{(1.10)^4}$$

$$NPV_{10\%} = -\$56.50$$

The project would be rejected by an all-equity firm: $NPV < 0$.

APV Example

- Now, imagine that the firm finances the project with \$600 of debt at R_B = 8%.
- Pearson's tax rate is 40%, so they have an interest tax shield worth $T_C B R_B = .40 \times \$600 \times .08 = \$19.20$ each year.
- The net present value of the project under leverage is:

$$APV = NPV + NPV_{debt\ tax\ shield}$$

$$APV = -\$56.50 + \sum_{t=1}^{4} \frac{\$19.20}{(1.08)^t}$$

$$APV = -\$56.50 + 63.59 = \$7.09$$

- So, Pearson should accept the project *with debt*.

18.2 Flow to Equity Approach

- Discount the cash flow from the project to the equity holders of the levered firm at the cost of levered equity capital, R_S.
- There are three steps in the FTE Approach:
  - Step One: Calculate the levered cash flows (LCFs)
  - Step Two: Calculate R_S.
  - Step Three: Value the levered cash flows at R_S.

Step One: Levered Cash Flows

- Since the firm is using $600 of debt, the equity holders only have to provide $400 of the initial $1,000 investment.
- Thus, CF_0 = –$400
- Each period, the equity holders must pay interest expense. The after-tax cost of the interest is:

  $B \times R_B \times (1 - T_C) = \$600 \times .08 \times (1 - .40) = \$28.80$

Step One: Levered Cash Flows

$CF_3 = \$375 - 28.80$

$CF_4 = \$500 - 28.80 - 600$

$CF_2 = \$250 - 28.80$

$CF_1 = \$125 - 28.80$

–$400	$96.20	$221.20	$346.20	–$128.80
0	1	2	3	4

Step Two: Calculate R_S

$$R_S = R_0 + \frac{B}{S}(1 - T_C)(R_0 - R_B)$$

To calculate the debt to equity ratio, $\frac{B}{S}$, start with $\frac{B}{V}$

$$PV = \frac{\$125}{(1.10)} + \frac{\$250}{(1.10)^2} + \frac{\$375}{(1.10)^3} + \frac{\$500}{(1.10)^4} + \sum_{t=1}^{4} \frac{19.20}{(1.08)^t}$$

PV = \$943.50 + \$63.59 = \$1,007.09

B = \$600 when V = \$1,007.09 so S = \$407.09.

$$R_S = .10 + \frac{\$600}{\$407.09}(1 - .40)(.10 - .08) = 11.77\%$$

Step Three: Valuation

- Discount the cash flows to equity holders at $R_S = 11.77\%$

–$400	$96.20	$221.20	$346.20	–$128.80
0	*1*	*2*	*3*	*4*

$$NPV = -\$400 + \frac{\$96.20}{(1.1177)} + \frac{\$221.20}{(1.1177)^2} + \frac{\$346.20}{(1.1177)^3} - \frac{\$128.80}{(1.1177)^4}$$

$$NPV = \$28.56$$

18.3 WACC Method

$$R_{WACC} = \frac{S}{S+B} R_S + \frac{B}{S+B} R_B (1 - T_C)$$

- To find the value of the project, discount the unlevered cash flows at the weighted average cost of capital.
- Suppose Pearson's target debt to equity ratio is 1.50

WACC Method

$$1.50 = \frac{B}{S} \qquad \therefore 1.5S = B$$

$$\frac{B}{S+B} = \frac{1.5S}{S+1.5S} = \frac{1.5}{2.5} = 0.60 \qquad \frac{S}{S+B} = 1 - 0.60 = 0.40$$

$$R_{WACC} = (0.40) \times (11.77\%) + (0.60) \times (8\%) \times (1 - .40)$$
$$R_{WACC} = 7.58\%$$

WACC Method

- To find the value of the project, discount the unlevered cash flows at the weighted average cost of capital

$$NPV = -\$1{,}000 + \frac{\$125}{(1.0758)} + \frac{\$250}{(1.0758)^2} + \frac{\$375}{(1.0758)^3} + \frac{\$500}{(1.0758)^4}$$

$$NPV_{7.58\%} = \$6.68$$

18.4 A Comparison of the APV, FTE, and WACC Approaches

- All three approaches attempt the same task: valuation in the presence of debt financing.
- Guidelines:
  - Use *WACC* or *FTE* if the firm's target debt-to-value ratio applies to the project over the life of the project.
  - Use the *APV* if the project's level of debt is known over the life of the project.
- In the real world, the *WACC* is, by far, the most widely used.

Summary: APV, FTE, and WACC

	APV	WACC	FTE
Initial Investment	All	All	Equity Portion
Cash Flows	*UCF*	*UCF*	*LCF*
Discount Rates	R_0	R_{WACC}	R_S
PV of financing effects	Yes	No	No

Summary: APV, FTE, and WACC

Which approach is best?

- Use *APV* when the *level* of debt is constant
- Use *WACC* and *FTE* when the debt *ratio* is constant
  - *WACC* is by far the most common
  - *FTE* is a reasonable choice for a highly levered firm

18.5 Valuation When the Discount Rate Must Be Estimated

- A *scale-enhancing* project is one where the project is similar to those of the existing firm.
- In the real world, executives would make the assumption that the business risk of the non-scale-enhancing project would be about equal to the business risk of firms already in the business.
- No exact formula exists for this. Some executives might select a discount rate slightly higher on the assumption that the new project is somewhat riskier since it is a new entrant.

Beta and Leverage: No Corporate Taxes

- In a world without corporate taxes, and with **riskless** corporate debt ($\beta_{Debt} = 0$), it can be shown that the relationship between the beta of the unlevered firm and the beta of levered equity is:

$$\beta_{\text{Asset}} = \frac{\text{Equity}}{\text{Asset}} \times \beta_{\text{Equity}}$$

- In a world without corporate taxes, and with **risky** corporate debt, it can be shown that the relationship between the beta of the unlevered firm and the beta of levered equity is:

$$\beta_{\text{Asset}} = \frac{\text{Debt}}{\text{Asset}} \times \beta_{\text{Debt}} + \frac{\text{Equity}}{\text{Asset}} \times \beta_{\text{Equity}}$$

Beta and Leverage: With Corporate Taxes

- In a world with corporate taxes, and riskless debt, it can be shown that the relationship between the beta of the unlevered firm and the beta of levered equity is:

$$\beta_{\text{Equity}} = \left(1 + \frac{\text{Debt}}{\text{Equity}} \times (1 - T_C)\right)\beta_{\text{Unlevered firm}}$$

- Since $\left(1 + \frac{\text{Debt}}{\text{Equity}} \times (1 - T_C)\right)$ must be more than 1 for a levered firm, it follows that $\beta_{\text{Equity}} > \beta_{\text{Unlevered firm}}$

Beta and Leverage: With Corporate Taxes

- If the beta of the debt is non-zero (i.e., not risk free), then:

$$\beta_{\text{Equity}} = \beta_{\text{Unlevered firm}} + (1 - T_C)(\beta_{\text{Unlevered firm}} - \beta_{\text{Debt}}) \times \frac{B}{S_L}$$

- If the debt is risk free:

$$\beta_{\text{Equity}} = [1 + (1 - T_C)\ B/S_L]*\beta_{\text{Unlevered Firm}}.$$

Summary

1. The APV formula can be written as:

$$APV = \sum_{t=1}^{\infty} \frac{UCF_t}{(1+R_0)^t} + \begin{matrix}\text{Additional}\\ \text{effects of}\\ \text{debt}\end{matrix} - \begin{matrix}\text{Initial}\\ \text{investment}\end{matrix}$$

2. The FTE formula can be written as:

$$FTE = \sum_{t=1}^{\infty} \frac{LCF_t}{(1+R_S)^t} - \left(\begin{matrix}\text{Initial}\\ \text{investment}\end{matrix} - \begin{matrix}\text{Amount}\\ \text{borrowed}\end{matrix} \right)$$

3. The WACC formula can be written as

$$NPV_{WACC} = \sum_{t=1}^{\infty} \frac{UCF_t}{(1+R_{WACC})^t} - \begin{matrix}\text{Initial}\\ \text{investment}\end{matrix}$$

Summary

4. Use the WACC or FTE if the firm's target debt to value ratio applies to the project over its life.
   - WACC is the most commonly used by far.
   - FTE has appeal for a firm deeply in debt.
5. The APV method is used if the level of debt is known over the project's life.
   - The APV method is frequently used for special situations like interest subsidies, LBOs, and leases.
6. The beta of the equity of the firm is positively related to the leverage of the firm.

Lecture 13

Dividends and Other Payouts

Key Concepts and Skills

- Understand dividend types and how they are paid
- Understand the issues surrounding dividend policy decisions
- Understand why share repurchases are an alternative to dividends
- Understand the difference between cash and stock dividends

19.1 Different Types of Payouts

- Many companies pay a **regular cash dividend**.
  - Public companies often pay quarterly.
  - Sometimes firms will pay an extra cash dividend.
  - The extreme case would be a liquidating dividend.
- Companies will often declare **stock dividends.**
  - No cash leaves the firm.
  - The firm increases the number of shares outstanding.
- Some companies declare a **dividend in kind**.
  - Wrigley’s Gum sends a box of chewing gum.
- Other companies use **stock buybacks**.

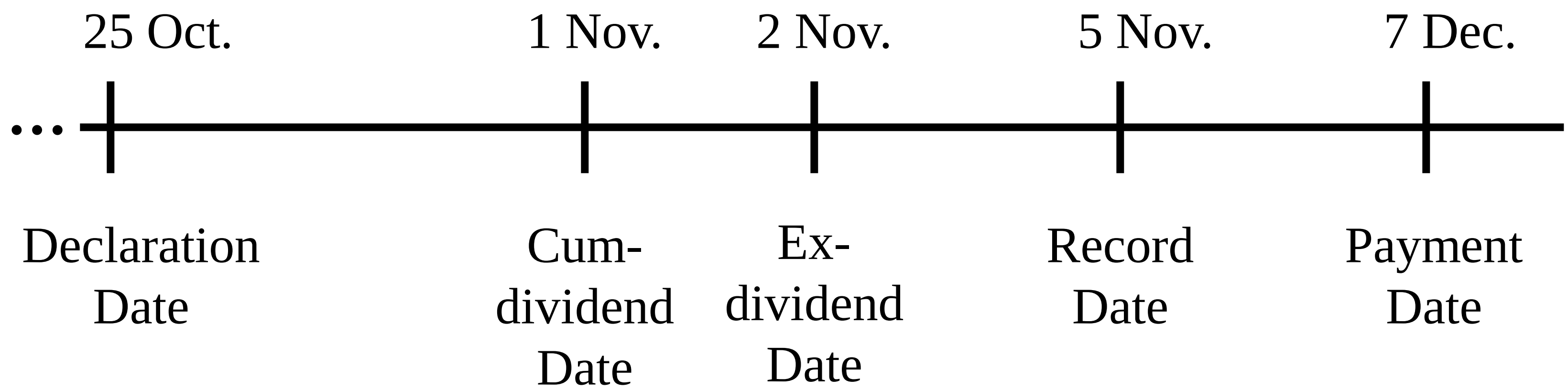
19.2 Standard Method of Cash Dividend

Cash Dividend - Payment of cash by the firm to its shareholders.

Ex-Dividend Date - Date that determines whether a stockholder is entitled to a dividend payment; anyone holding stock immediately before this date is entitled to a dividend.

Record Date – Date on which company determines existing shareholders.

Procedure for Cash Dividend



Declaration Date: The Board of Directors declares a payment of dividends.

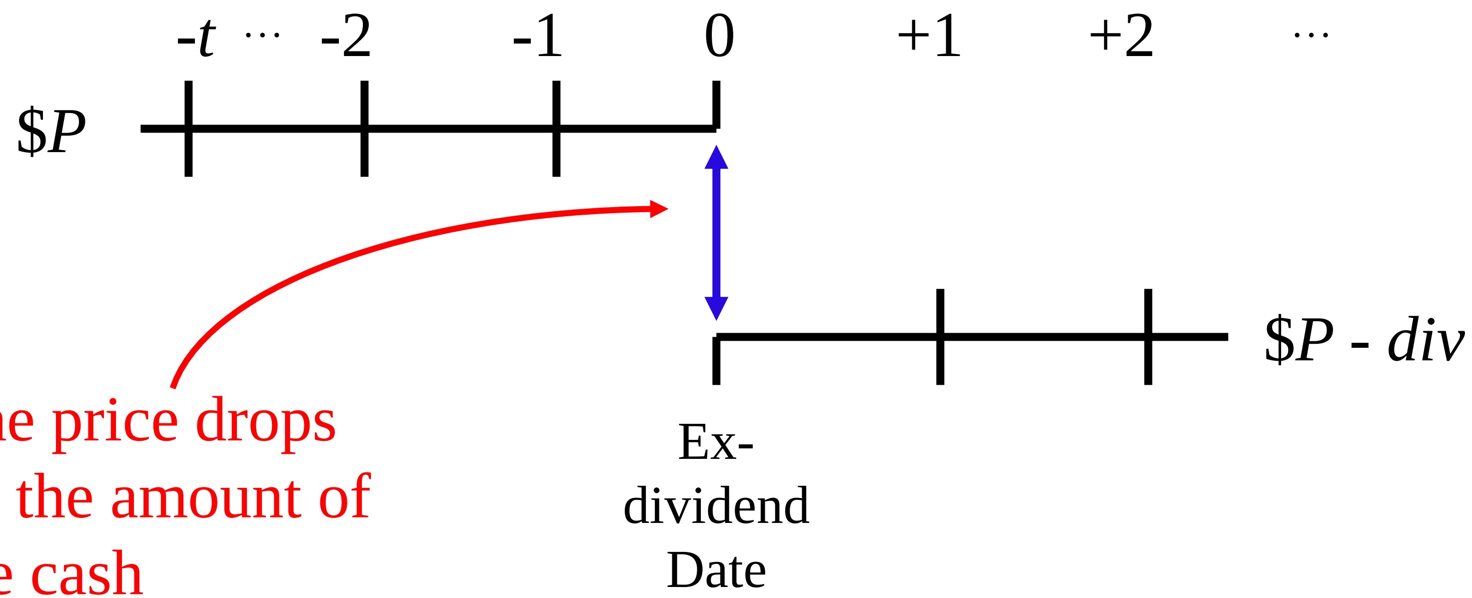
Cum-Dividend Date: Buyer of stock still receives the dividend.

Ex-Dividend Date: Seller of the stock retains the dividend.

Record Date: The corporation prepares a list of all individuals believed to be stockholders as of 5 November.

Price Behavior

- In a perfect world, the stock price will fall by the amount of the dividend on the ex-dividend date.



The price drops by the amount of the cash dividend.

Taxes complicate things a bit. Empirically, the price drop is less than the dividend and occurs within the first few minutes of the ex-date.

19.3 The Irrelevance of Dividend Policy

- A compelling case can be made that dividend *policy* is irrelevant.
- Since investors do not need dividends to convert shares to cash; they will not pay higher prices for firms with higher dividends.
- In other words, dividend policy will have no impact on the value of the firm because investors can create whatever income stream they prefer by using homemade dividends.

Homemade Dividends

- Bianchi Inc. is a $42 stock about to pay a $2 cash dividend.
- Bob Investor owns 80 shares and prefers a $3 dividend.
- Bob's homemade dividend strategy:
  - Sell 2 shares ex-dividend

	homemade dividends	$3 Dividend
Cash from dividend	$160	$240
Cash from selling stock	$80	$0
Total Cash	$240	$240
Value of Stock Holdings	$40 × 78 = $3,120	$39 × 80 = $3,120

Dividend Policy Is Irrelevant

- In the above example, Bob Investor began with a total wealth of $3,360:

$$\$3,360 = 80 \text{ shares} \times \frac{\$42}{\text{share}}$$

  - After a $3 dividend, his total wealth is still $3,360:

$$\$3,360 = 80 \text{ shares} \times \frac{\$39}{\text{share}} + \$240$$

  - After a $2 dividend and sale of 2 ex-dividend shares, his total wealth is still $3,360:

$$\$3,360 = 78 \text{ shares} \times \frac{\$40}{\text{share}} + \$160 + \$80$$

Dividends and Investment Policy

- Firms should never forgo positive NPV projects to increase a dividend (or to pay a dividend for the first time).
- Recall that one of the assumptions underlying the dividend-irrelevance argument is: “The investment policy of the firm is set ahead of time and is not altered by changes in dividend policy.”

19.4 Repurchase of Stock

- Instead of declaring cash dividends, firms can rid themselves of excess cash through buying shares of their own stock.
- Recently, share repurchase has become an important way of distributing earnings to shareholders.

Stock Repurchase versus Dividend

Consider a firm that wishes to distribute $100,000 to its shareholders.

Assets		***Liabilities & Equity***	
A. Original balance sheet			
Cash	$150,000	Debt	0
Other Assets	850,000	Equity	1,000,000
Value of Firm	1,000,000	Value of Firm	1,000,000

Shares outstanding = 100,000

Price per share = $1,000,000 / 100,000 = $10

Stock Repurchase versus Dividend

If they distribute the $100,000 as a cash dividend, the balance sheet will look like this:

Assets		***Liabilities & Equity***	
B. After $1 per share cash dividend			
Cash	$50,000	Debt	0
Other Assets	850,000	Equity	900,000
Value of Firm	900,000	Value of Firm	900,000

Shares outstanding = 100,000

Price per share = $900,000/100,000 = $9

Stock Repurchase versus Dividend

If they distribute the $100,000 through a stock repurchase, the balance sheet will look like this:

Assets ***Liabilities & Equity***

C. After stock repurchase

Cash	$50,000	Debt	0
Other Assets	850,000	Equity	900,000
Value of Firm	900,000	Value of Firm	900,000

Shares outstanding = 90,000

Price per share = $900,000 / 90,000 = $10

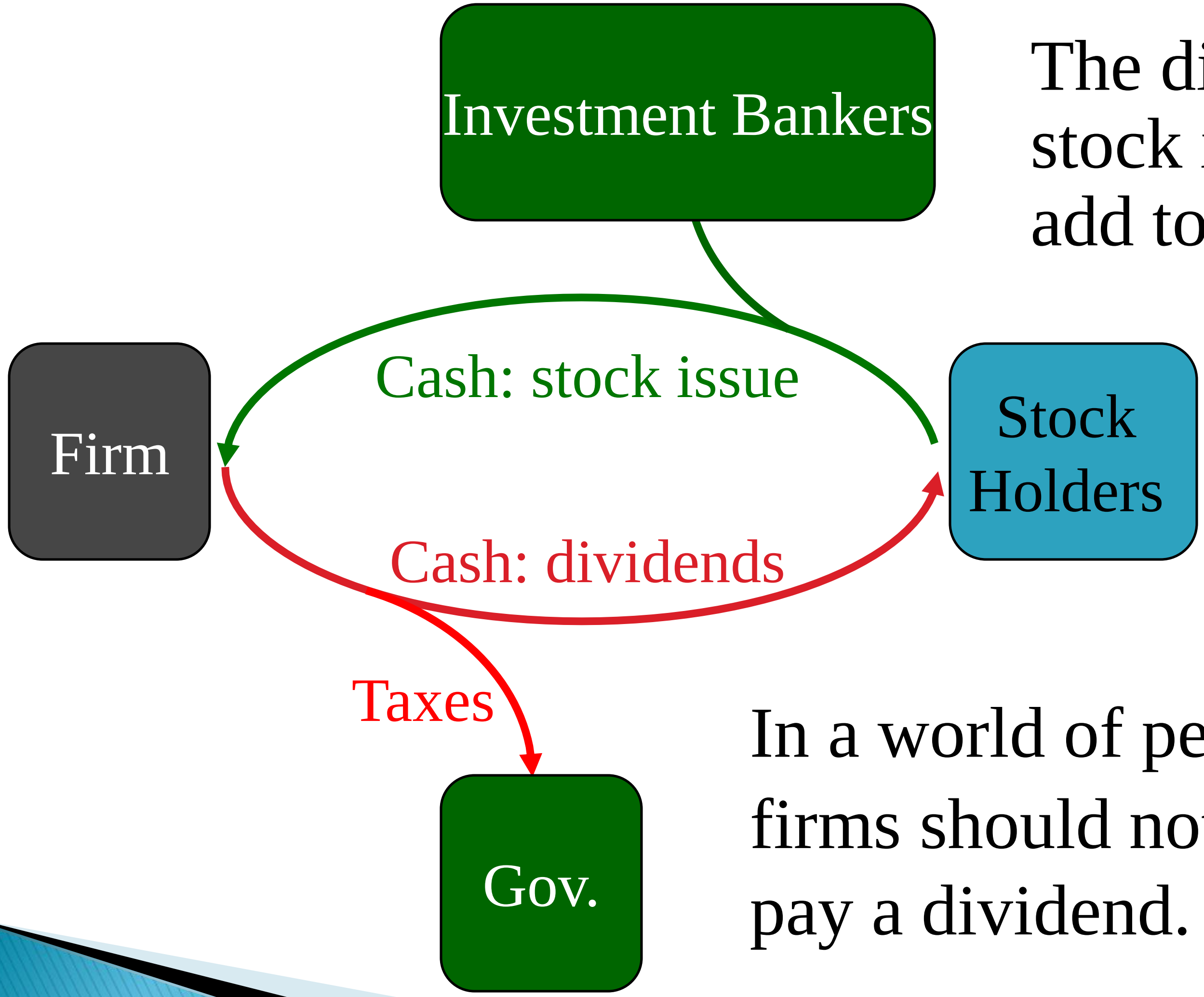
Share Repurchase

- Flexibility for shareholders
- Keeps stock price higher
  - Good for insiders who hold stock options
- As an investment of the firm (undervaluation)
- Tax benefits

19.5 Personal Taxes, Dividends, and Stock Repurchases

- To get the result that dividend policy is irrelevant, we needed three assumptions:
  - No taxes
  - No transactions costs
  - No uncertainty
- In the United States, both cash dividends and capital gains are (currently) taxed at a maximum rate of 15 percent.
- Since capital gains can be deferred, the tax rate on dividends is greater than the *effective* rate on capital gains.

Firms without Sufficient Cash



The direct costs of stock issuance will add to this effect.

In a world of personal taxes, firms should not issue stock to pay a dividend.

Firms with Sufficient Cash

- The above argument does not necessarily apply to firms with excess cash.
- Consider a firm that has $1 million in cash *after selecting all available positive NPV projects*.
  - Select additional capital budgeting projects (by assumption, these are negative NPV).
  - Acquire other companies
  - Purchase financial assets
  - Repurchase shares

Taxes and Dividends

- In the presence of personal taxes:
  1. A firm should not issue stock to pay a dividend.
  2. Managers have an incentive to seek alternative uses for funds to reduce dividends.
  3. Though personal taxes mitigate against the payment of dividends, these taxes are not sufficient to lead firms to eliminate all dividends.

19.6 Real-World Factors Favoring High Dividends

- Desire for Current Income
- Behavioral Finance
  - It forces investors to be disciplined.
- Tax Arbitrage
  - Investors can create positions in high dividend yield securities that avoid tax liabilities.
- Agency Costs
  - High dividends reduce free cash flow.

19.7 The Clientele Effect

- Clienteles for various dividend payout policies are likely to form in the following way:

Group	Stock Type
High Tax Bracket Individuals	Zero-to-Low payout
Low Tax Bracket Individuals	Low-to-Medium payout
Tax-Free Institutions	Medium payout
Corporations	High payout

Once the clienteles have been satisfied, a corporation is unlikely to create value by *changing* its dividend policy.

19.8 What We Know and Do Not Know

- Corporations "smooth" dividends.
- Fewer companies are paying dividends.
- Dividends provide information to the market.
- Firms should follow a sensible policy:
  - Do not forgo positive NPV projects just to pay a dividend.
  - Avoid issuing stock to pay dividends.
  - Consider share repurchase when there are few better uses for the cash.

19.9 Putting It All Together

- Aggregate payouts are massive and have increased over time.
- Dividends are concentrated among a small number of large, mature firms.
- Managers are reluctant to cut dividends.
- Managers smooth dividends.
- Stock prices react to unanticipated changes in dividends.

General Dividend Guidelines

- Over time pay out all free cash flows
- Avoid cutting positive NPV projects to pay dividends or buy back shares
- Do not initiate dividends until the firm is generating substantial free cash flows
- Set the current regular dividend consistent with a long-run target payout ratio
- Set the level of dividends low enough to avoid expensive future external financing
- Use repurchases to distribute transitory cash flow increases

19.10 Stock Dividends

- Pay additional shares of stock instead of cash
- Increases the number of outstanding shares
- Small stock dividend
  - Less than 20 to 25%
  - If you own 100 shares and the company declared a 10% stock dividend, you would receive an additional 10 shares.
- Large stock dividend – more than 20 to 25%

Stock Splits

- Stock splits – essentially the same as a stock dividend except it is expressed as a ratio
  - For example, a 2 for 1 stock split is the same as a 100% stock dividend.
- Stock price is reduced when the stock splits.
- Common explanation for split is to return price to a "more desirable trading range."

Lecture 14

Raising Capital

Key Concepts and Skills

- Understand the venture capital market and its role in financing new businesses
- Understand how securities are sold to the public and the role of investment bankers
- Understand initial public offerings and the costs of going public
- Understand the process of secondary offerings and the impact of dilution

Venture Capitalists (VCs)

- Financial intermediaries that are typically set up as limited partnerships
- Play an active role in overseeing, advising, and monitoring companies in which they invest
- Generally do not want to own the investment forever

Stages of Financing

1. Seed-Money Stage
   - Prove concept, develop product
2. Start-Up
   - Marketing and product development
3. First-Round Financing
   - Sales and marketing, manufacturing for physical products
4. Second-Round Financing
   - Working capital
5. Third-Round Financing (mezzanine)
6. Fourth-Round Financing (bridge)

20.2 The Public Issue

- The Basic Procedure
  - Management gets the approval of the Board.
  - The firm prepares and files a *registration statement* with the SEC.
  - The SEC studies the registration statement during the *waiting period.*
  - The firm prepares and files an *amended* registration statement with the SEC.
  - If everything is fine with the SEC, a price is set and a full-fledged selling effort gets underway.

The Process of a Public Offering

Steps in Public Offering	Time
1. Pre-underwriting conferences	Several months
2. Registration statements	20-day waiting period
3. Pricing the issue	Usually on the 20th day
4. Public offering and sale	After the 20th day
5. Market stabilization	30 days after offering

An Example of a Tombstone

7,540,872 Shares

ShopKo

ShopKo Stores, Inc.

Common Stock
(par value $.01 per share)

Price $25 Per Share

Upon request, a copy of the Prospectus describing these securities and the business of the Company may be obtained within any State from any Underwriter who may legally distribute it within such State. The securities are offered only by means of the Prospectus, and this announcement is neither an offer to sell nor a solicitation of an offer to buy.

6,032,698 Shares

This portion of the offering is being offered in the United States by the undersigned.

Goldman, Sachs & Co.

Merrill Lynch & Co.

Salomon Brothers Inc

Alex. Brown & Sons Incorporated

Montgomery Securities

Robert W. Baird & Co. Incorporated

C.L. King & Associates, Inc.

Nesbitt Burns Securities Inc.

1,508,174 Shares

This portion of the offering is being offered outside the United States by the undersigned.

20.3 Alternative Issue Methods

- There are two kinds of public issues:
  - The general cash offer
  - The rights offer
- Almost all debt is sold in general cash offerings.

Table 20.1 – I

Method	Type	Definition
Public Traditional negotiated cash offer	Firm commitment cash offer	Company negotiates an agreement with an investment banker to underwrite and distribute the new shares. A specified number of shares are bought by underwriters and sold at a higher price.
	Best efforts cash offer	Company has investment bankers sell as many of the new shares as possible at the agreed-upon price. There is no guarantee concerning how much cash will be raised.
	Dutch auction cash offer	Company has investment bankers auction shares to determine the highest offer price obtainable for a given number of shares to be sold.
Privileged subscription	Direct rights offer	Company offers the new stock directly to its existing shareholders.
	Standby rights offer	Like the direct rights offer, this contains a privileged subscription arrangement with existing shareholders. The net proceeds are guaranteed by the underwriters.

Table 20.1 – II

Method	Type	Definition
Public		
Nontraditional cash offer	Shelf cash offer	Qualifying companies can authorize all shares they expect to sell over a two-year period and sell them when needed.
	Competitive firm cash offer	Company can elect to award the underwriting contract through a public auction instead of negotiation.
Private	Direct placement	Securities are sold directly to the purchaser, who, at least until recently, generally could not resell securities for at least two years.

20.4 The Cash Offer

- There are three methods for issuing securities for cash:
  - Firm Commitment
  - Best Efforts
  - Dutch Auction
- There are two methods for selecting an underwriter
  - Competitive
  - Negotiated

Firm Commitment Underwriting

- The issuing firm sells the entire issue to the underwriting syndicate.
- The syndicate then resells the issue to the public.
- The underwriter makes money on the spread between the price paid to the issuer and the price received from investors when the stock is sold.
- The syndicate bears the risk of not being able to sell the entire issue for more than the cost.
- This is the most common type of underwriting in the United States.

Best Efforts Underwriting

- Underwriter must make their “best effort” to sell the securities at an agreed-upon offering price.
- The company bears the risk of the issue not being sold.
- The offer may be pulled if there is not enough interest at the offer price. The company does not get the capital, and they have still incurred substantial flotation costs.
- This type of underwriting is not as common as it used to be.

Dutch Auction Underwriting

- Underwriter accepts a series of bids that include number of shares and price per share.
- The price that everyone pays is the highest price that will result in all shares being sold.
- There is an incentive to bid high to make sure you get in on the auction but knowing that you will probably pay a lower price than you bid.
- The Treasury has used Dutch auctions for years.
- Google was the first large Dutch auction IPO.

Investment Banks

- Also called underwriters in this context
- Perform critical functions:
  - Help determine type of security, method of sale, and offering price
  - Sell the securities
    - Typically using a syndicate to limit risk
    - For compensation – the spread
  - Stabilize IPO prices in the aftermarket

IPO Underpricing

- May be difficult to price an IPO because there is not a current market price available.
- Private companies tend to have more asymmetric information than companies that are already publicly traded.
- Underwriters want to ensure that, on average, their clients earn a good return on IPOs.
- Underpricing causes the issuer to “leave money on the table.”

20.5 The Announcement of New Equity and the Value of the Firm

- The market value of *existing* equity drops on the announcement of a new issue of common stock.
- Reasons include
  - Managerial Information

    Since the managers are the insiders, perhaps they are selling new stock because they think it is overpriced.
  - Debt Capacity

    If the market infers that the managers are issuing new equity to reduce their debt-equity ratio due to the specter of financial distress, the stock price will fall.
  - Issue Costs

20.6 The Cost of New Issues

1. Gross spread, or underwriting discount
2. Other direct expenses
3. Indirect expenses
4. Abnormal returns
5. Underpricing
6. Green Shoe Option
   - Right to buy additional shares to cover over-allotment

The Costs of Equity Public Offerings

Proceeds (in millions)	Direct Costs SEOs	Direct Costs IPOs	Underpricing IPOs
2 - 9.99	35.11%	25.22%	20.42%
10 - 19.99	13.86%	14.69%	10.33%
20 - 39.99	9.54%	14.03%	17.03%
40 - 59.99	13.96%	9.77%	28.26%
60 - 79.99	6.85%	8.94%	28.36%
80 - 99.99	6.72%	8.55%	32.92%
100 - 199.99	5.23%	7.96%	21.55%
200 - 499.99	4.94%	6.84%	6.19%
500 and up	3.37%	5.50%	6.64%

20.7 Rights

- If a preemptive right is contained in the firm's articles of incorporation, the firm must offer any new issue of common stock first to existing shareholders.
- This allows shareholders to maintain their percentage ownership if they so desire.

Mechanics of Rights Offerings

- The management of the firm must decide:
  - The exercise price (the price existing shareholders must pay for new shares).
  - How many rights will be required to purchase one new share of stock.
- These rights have value:
  - Shareholders can either exercise their rights or sell their rights.

Rights Offering Example

- Popular Delusions, Inc. is proposing a rights offering. There are 200,000 shares outstanding trading at $25 each. There will be 10,000 new shares issued at a $20 subscription price.
- What is the new market value of the firm?
- What is the ex-rights price?
- What is the value of a right?

What is the new market value of the firm?

$$\$5{,}200{,}000 = \underbrace{200{,}000 \text{ shares} \times \frac{\$25}{\text{share}}}_{\text{There are 200,000 outstanding shares at \$25 each.}} + \underbrace{10{,}000 \text{ shares} \times \frac{\$20}{\text{shares}}}_{\text{There will be 10,000 new shares issued at a \$20 subscription price.}}$$

What Is the Ex-Rights Price?

- There are 110,000 outstanding shares of a firm with a market value of $5,200,000.
- Thus the value of an ex-rights share is:

$$\frac{\$5{,}200{,}000}{210{,}000 \text{ shares}} = \$24.7619$$

What Is the Ex-Rights Price?

- Thus, the value of a right is:

$$\$0.2381 = \$25 - \$24.7619$$

- Or ($24.7619 - $20)/20

- Where 20 = #old shares/#new shares = 200,000/10,000

20.8 The Rights Puzzle

- The vast majority of new issues in the U.S. are underwritten, even though rights offerings are much cheaper.
- A few explanations:
  - Underwriters increase the stock price. There is not much evidence for this, but it sounds good.
  - The underwriter provides a form of insurance to the issuing firm in a firm-commitment underwriting.
  - Underwriters “certify” the price to the market.
  - The proceeds from underwriting may be available sooner than the proceeds from a rights offering.

20.9 Dilution

- Dilution is a loss in value for existing shareholders:
  - Percentage ownership – shares sold to the general public without a rights offering
  - Market value – firm accepts negative NPV projects
  - Earnings per share – may decline even with positive NPV projects (at least in short run)
  - Book value– occurs when market-to-book value is less than one

20.10 Shelf Registration

- Permits a corporation to register an offering that it reasonably expects to sell within the next two years.
- Not all companies are allowed shelf registration.
- Qualifications include:
  - The firm must be rated investment grade.
  - They cannot have recently defaulted on debt.
  - The market capitalization must be $\geq$ \$150 m.
  - No recent SEC violations.

20.11 Issuing Long-Term Debt

- Public issuance follows the same general process as stocks
- Direct financing
  - Term loans
  - Private placements
- Direct financing may have more restrictive covenants and higher rates, but is less costly to issue and easier to negotiate.

Lecture 15

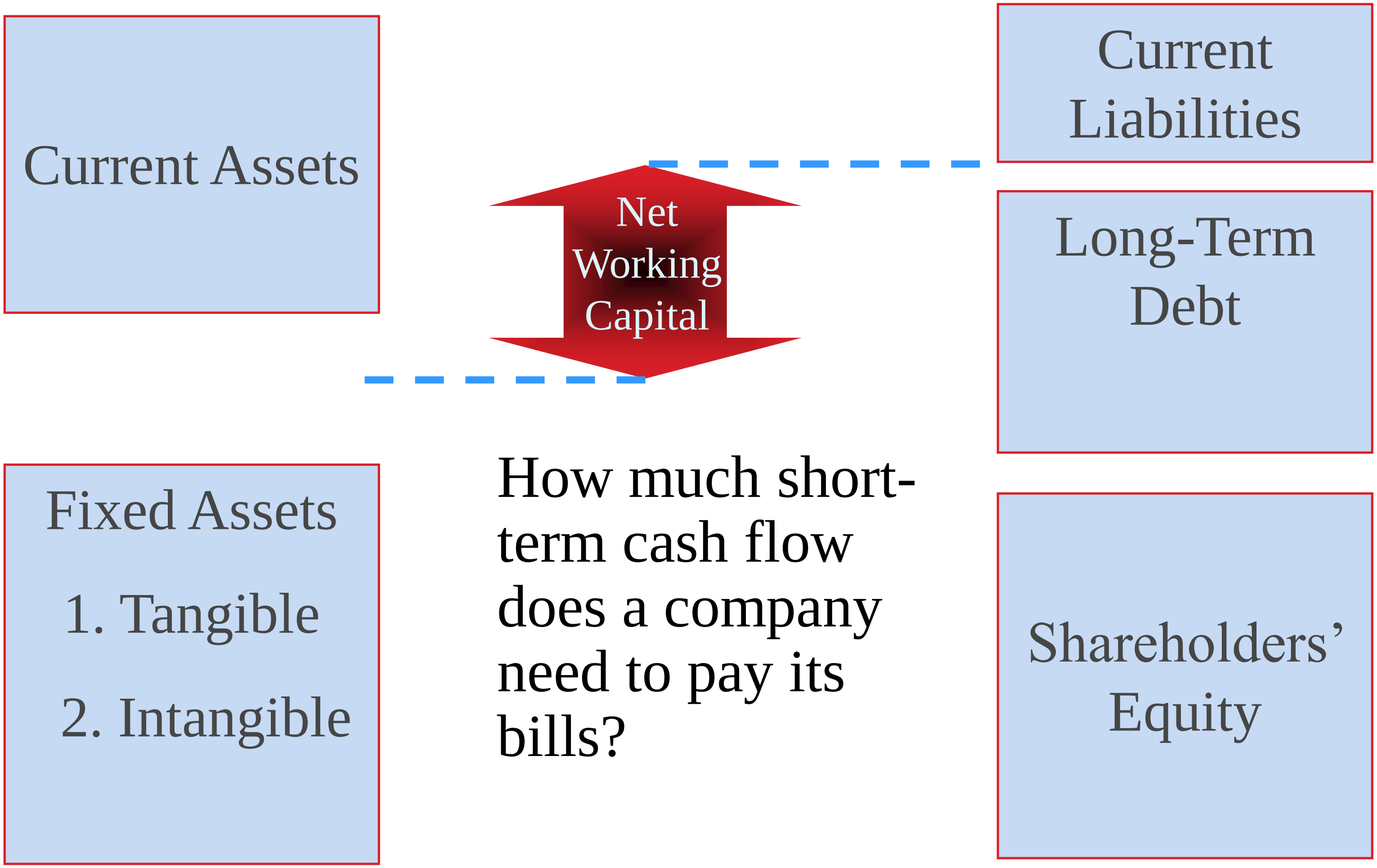
Short-Term Finance and Planning
Cash Management

Short-Term Finance and Planning

Key Concepts and Skills

- Understand the components of the cash cycle and why it is important
- Understand the pros and cons of the various short-term financing policies
- Be able to prepare a cash budget
- Understand the various options for short-term financing

Balance Sheet Model of the Firm



How much short-term cash flow does a company need to pay its bills?

26.1 Tracing Cash and Net Working Capital

- Current Assets are cash and other assets that are expected to be converted to cash within the year.
  - Cash
  - Marketable securities
  - Accounts receivable
  - Inventory
- Current Liabilities are obligations that are expected to require cash payment within the year.
  - Accounts payable
  - Accrued wages
  - Taxes

Defining Cash in Terms of Other Elements

$$\text{Net Working Capital} + \text{Fixed Assets} = \text{Long-Term Debt} + \text{Equity}$$

$$\text{Net Working Capital} = \text{Cash} + \text{Other Current Assets} - \text{Current Liabilities}$$

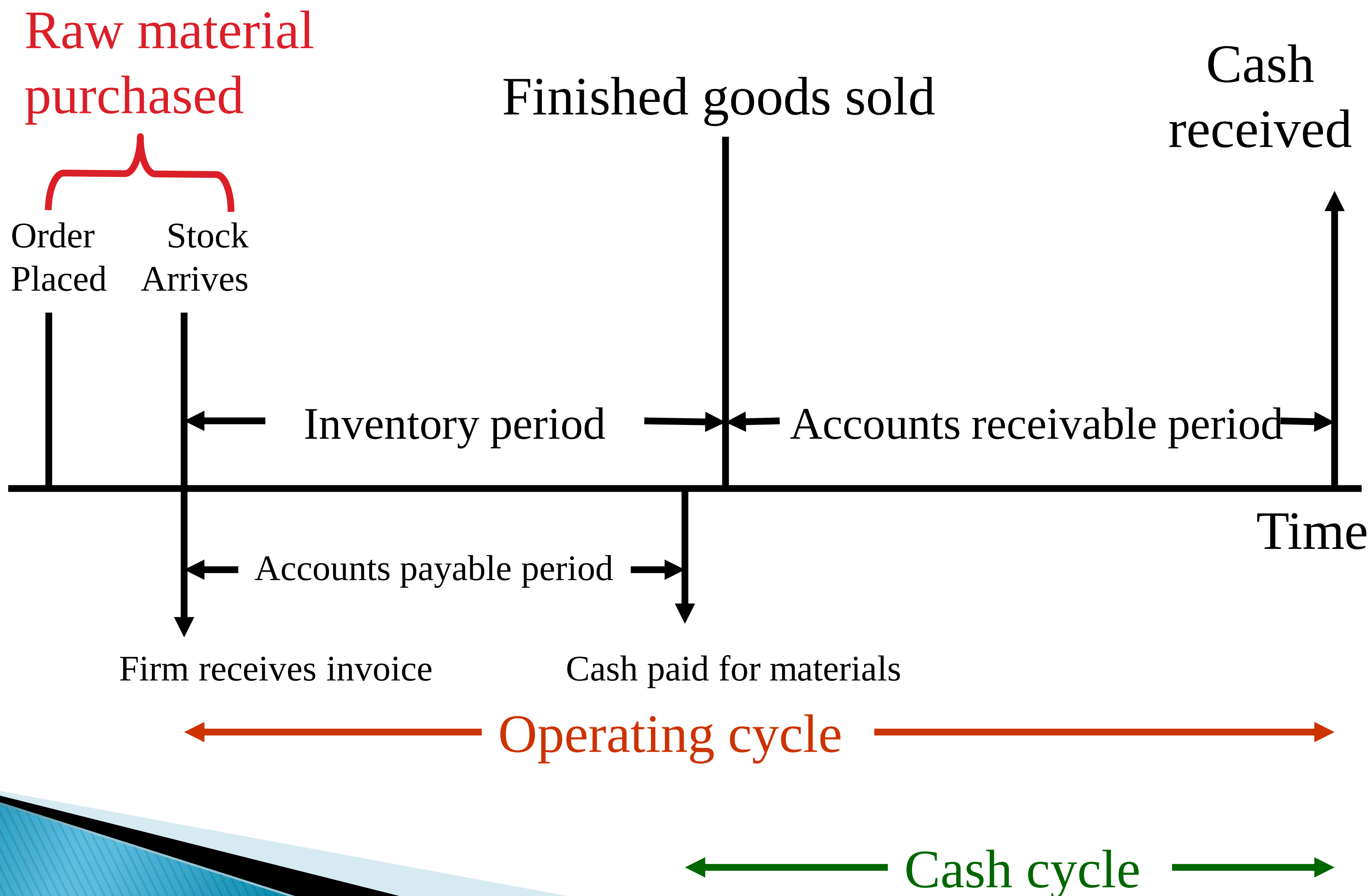
$$\text{Cash} = \text{Long-Term Debt} + \text{Equity} - \text{Net Working Capital (excluding cash)} - \text{Fixed Assets}$$

Defining Cash in Terms of Other Elements

$$\text{Cash} = \begin{array}{c}\text{Long-}\\\text{Term}\\\text{Debt}\end{array} + \text{Equity} - \begin{array}{c}\text{Net Working}\\\text{Capital}\\\text{(excluding cash)}\end{array} - \begin{array}{c}\text{Fixed}\\\text{Assets}\end{array}$$

- An increase in long-term debt and or equity leads to an increase in cash—as does a decrease in fixed assets or a decrease in the non-cash components of net working capital.
- The sources and uses of cash follow from this reasoning.

26.2 The Operating Cycle and the Cash Cycle



The Operating Cycle and the Cash Cycle

$$\text{Cash cycle} = \text{Operating cycle} - \begin{matrix}\text{Accounts}\\ \text{payable}\\ \text{period}\end{matrix}$$

- In practice, the inventory period, the accounts receivable period, and the accounts payable period are measured by days in inventory, days in receivables, and days in payables, respectively.

Example

- Inventory:
  - Beginning = 200,000
  - Ending = 300,000
- Accounts Receivable:
  - Beginning = 160,000
  - Ending = 200,000
- Accounts Payable:
  - Beginning = 75,000
  - Ending = 100,000
- Net sales = 1,150,000
- Cost of Goods sold = 820,000

Example

- Inventory period
  - Average inventory = (200,000+300,000)/2 = 250,000
  - Inventory turnover = 820,000 / 250,000 = 3.28 times
  - Inventory period = 365 / 3.28 = 111.3 days
- Receivables period
  - Average receivables = (160,000+200,000)/2 = 180,000
  - Receivables turnover = 1,150,000 / 180,000 = 6.39 times
  - Receivables period = 365 / 6.39 = 57.1 days
- Operating cycle = 111.3 + 57.1 = 168.4 days

Example

- Payables Period
  - Average payables = (75,000+100,000)/2 = 87,500
  - Payables turnover = 820,000 / 87,500 = 9.37 times
  - Payables period = 365 / 9.37 = 38.9 days
- Cash Cycle = 168.4 – 38.9 = 129.5 days
- We have to finance our inventory for 129.5 days.
- If we want to reduce our financing needs, we need to look carefully at our receivables and inventory periods – they both seem excessive.

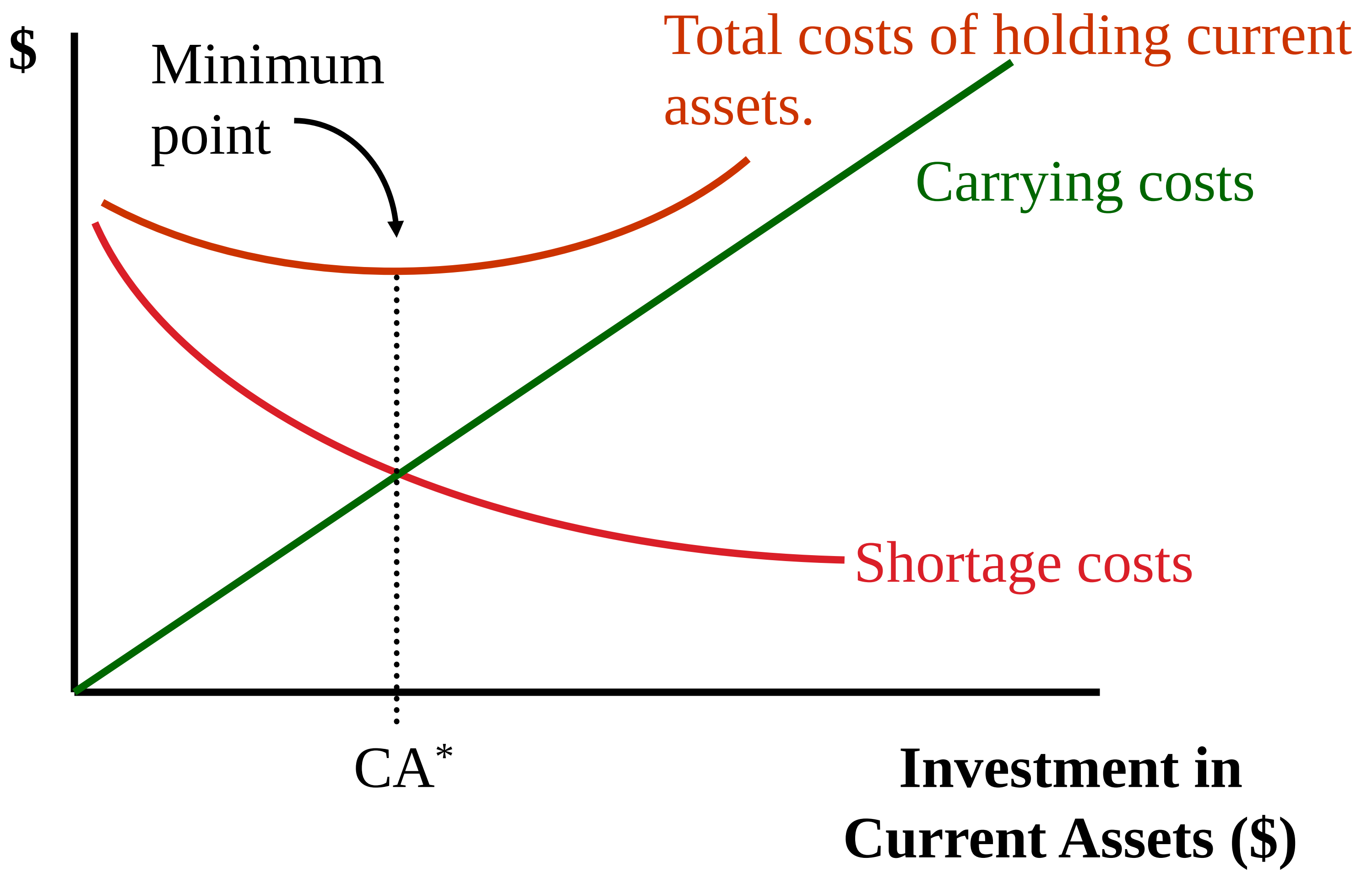
26.3 Some Aspects of Short-Term Financial Policy

- There are two elements of the policy that a firm adopts for short-term finance.
  - The size of the firm's investment in current assets, usually measured relative to the firm's level of total operating revenues.
    - Flexible
    - Restrictive
  - Alternative financing policies for current assets, usually measured as the proportion of short-term debt to long-term debt.
    - Flexible
    - Restrictive

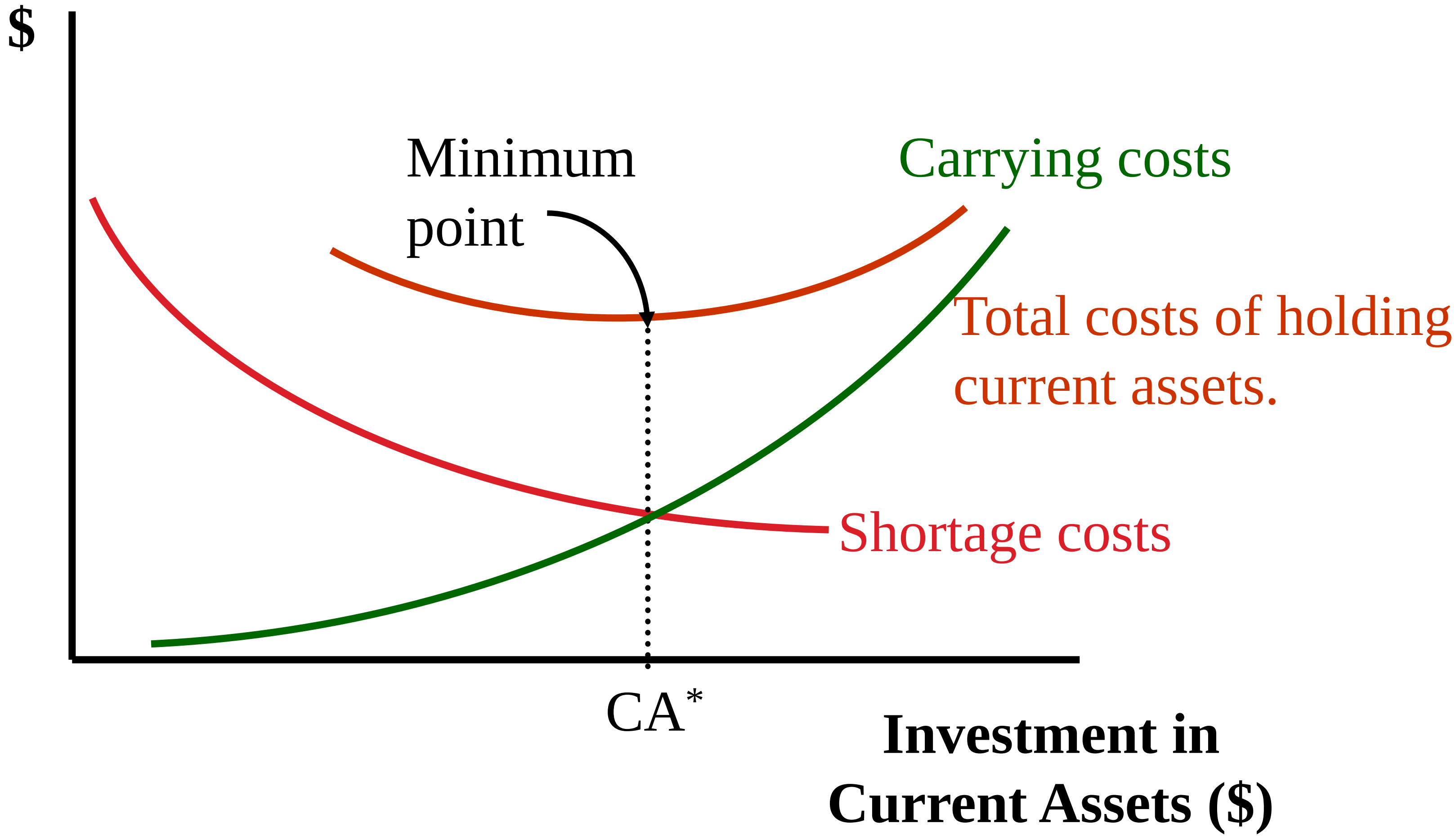
Size of Investment in Current Assets

- A flexible short-term finance policy would maintain a high ratio of current assets to sales.
  - Keeping large cash balances and investments in marketable securities
  - Large investments in inventory
  - Liberal credit terms
- A restrictive short-term finance policy would maintain a low ratio of current assets to sales.
  - Keeping low cash balances, no investment in marketable securities
  - Making small investments in inventory
  - Allowing no credit sales (thus no accounts receivable)

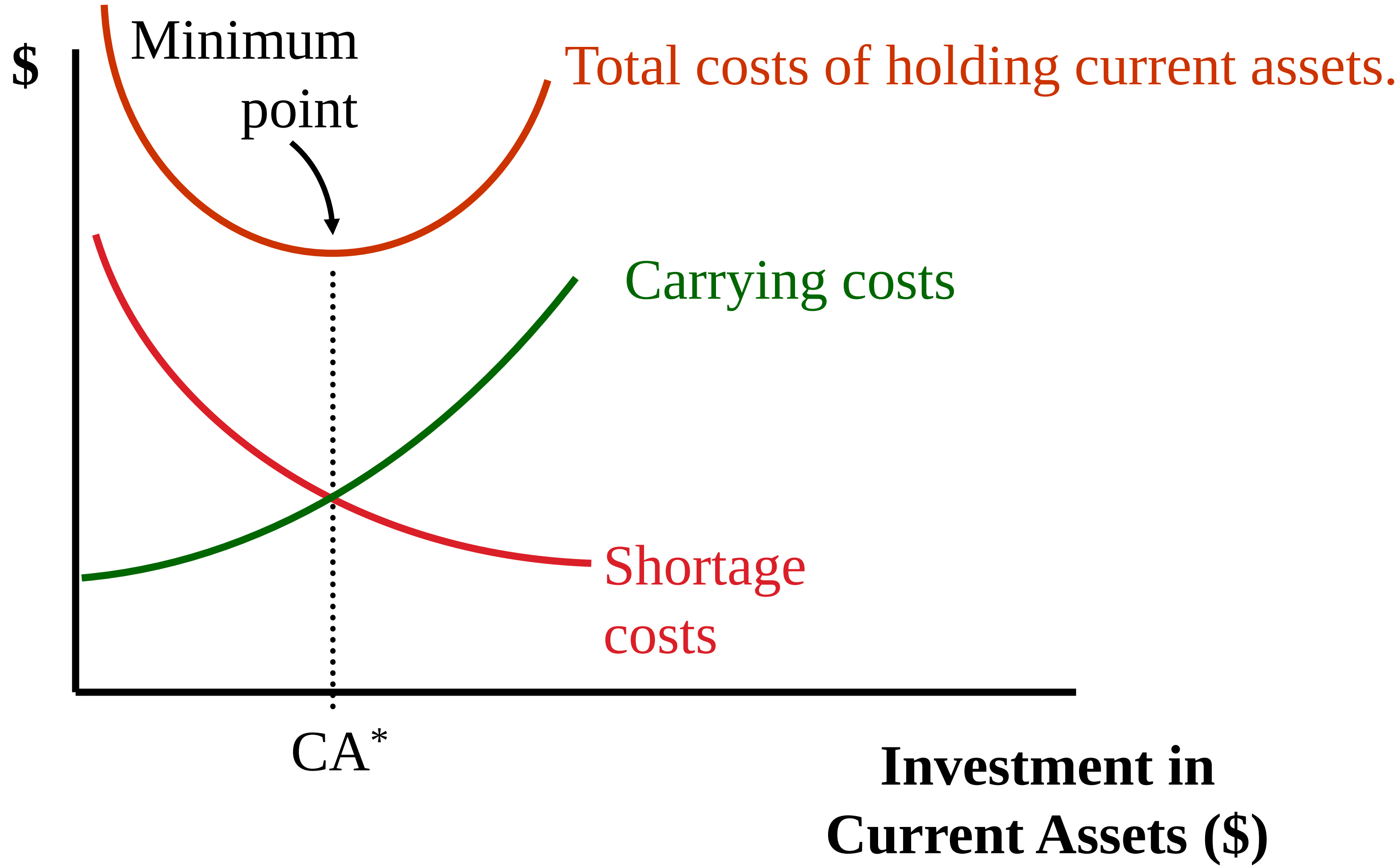
Carrying Costs and Shortage Costs



Appropriate Flexible Policy



Appropriate Restrictive Policy



Alternative Financing Policies

- A flexible short-term finance policy means a low proportion of short-term debt relative to long-term financing.
- A restrictive short-term finance policy means a high proportion of short-term debt relative to long-term financing.
- In an ideal world, short-term assets are always financed with short-term debt, and long-term assets are always financed with long-term debt.
  - In this world, net working capital is zero.

26.4 Cash Budgeting

- A cash budget is a primary tool of short-run financial planning.
- The idea is simple: Record the estimates of cash receipts and disbursements.
- Cash Receipts
  - Arise from sales, but we need to estimate when we actually collect
- Cash Outflow
  - Payments of Accounts Payable
  - Wages, Taxes, and other Expenses
  - Capital Expenditures
  - Long-Term Financial Planning

Example

- Pet Treats Inc. specializes in gourmet pet treats and receives all income from sales
- Sales estimates (in millions)
  - Q1 = 500; Q2 = 600; Q3 = 650; Q4 = 800; Q1 next year = 550
- Accounts receivable
  - Beginning receivables = $250
  - Average collection period = 30 days
- Accounts payable
  - Purchases = 50% of next quarter's sales
  - Beginning payables = 125
  - Accounts payable period is 45 days
- Other expenses
  - Wages, taxes and other expense are 30% of sales
  - Interest and dividend payments are $50
  - A major capital expenditure of $200 is expected in the second quarter
- The initial cash balance is $80 and the company maintains a minimum balance of $50

Example

- ACP = 30 days, this implies that 2/3 of sales are collected in the quarter made, and the remaining 1/3 are collected the following quarter.
- Beginning receivables of $250 will be collected in the first quarter.

	Q1	Q2	Q3	Q4
Beginning Receivables	250	167	200	217
Sales	500	600	650	800
Cash Collections	583	567	633	750
Ending Receivables	167	200	217	267

Example

- Payables period is 45 days, so half of the purchases will be paid for each quarter, and the remaining will be paid the following quarter.
- Beginning payables = $125

	Q1	Q2	Q3	Q4
Payment of accounts	275	313	362	338
Wages, taxes and other expenses	150	180	195	240
Capital expenditures		200		
Interest and dividend payments	50	50	50	50
Total cash disbursements	475	743	607	628

Example

	Q1	Q2	Q3	Q4
Total cash collections	583	567	633	750
Total cash disbursements	475	743	607	628
Net cash inflow	108	-176	26	122
Beginning Cash Balance	80	188	12	38
Net cash inflow	108	-176	26	122
Ending cash balance	188	12	38	160
Minimum cash balance	-50	-50	-50	-50
Cumulative surplus (deficit)	138	-39	-12	110

26.5 The Short-Term Financial Plan

- The most common way to finance a temporary cash deficit is to arrange a short-term loan.
- Unsecured Loans
  - Line of credit (at the bank)
- Secured Loans
  - Accounts receivable can be either *assigned* or *factored.*
  - Inventory loans use inventory as collateral.
- Other Sources
  - Banker's acceptance
  - Commercial paper

Cash Management

Key Concepts and Skills

- Understand the importance of float and how it affects the cash balance
- Understand how to accelerate collections and manage disbursements
- Understand the advantages and disadvantages of holding cash and some of the ways to invest idle cash

Reasons for Holding Cash

- Speculative motive – hold cash to take advantage of unexpected opportunities
- Precautionary motive – hold cash in case of emergencies
- Transaction motive – hold cash to pay the day-to-day bills
- Trade-off between opportunity cost of holding cash relative to the transaction cost of converting marketable securities to cash for transactions

Understanding Float

- Float – difference between cash balance recorded in the cash account and the cash balance recorded at the bank
- Disbursement float
  - Generated when a firm writes checks
  - Available balance at bank – book balance > 0
- Collection float
  - Checks received increase book balance before the bank credits the account
  - Available balance at bank – book balance < 0
- Net float = disbursement float + collection float

Example: Types of Float

- You have $3,000 in your checking account. You just deposited $2,000 and wrote a check for $2,500.
  - What is the disbursement float?
  - What is the collection float?
  - What is the net float?
  - What is your book balance?
  - What is your available balance?

Float Example Answers

- After writing the check you show a balance of $500 on your books, but the bank shows $3,000 while the check is clearing. Your disbursement float is $2,500.
- After the deposit, your book balance is $2,500. If this is by check, your *available* balance doesn't rise, and your collection float is -$2,000.
- Your net float is $500.
- Your available balance is $3,000, till the checks clear.

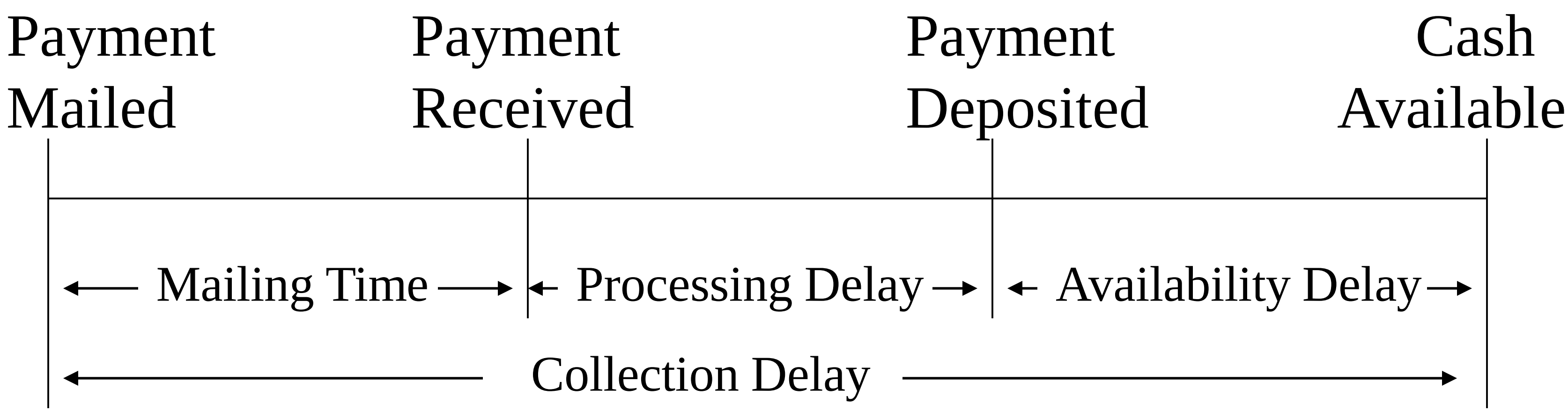
Example: Measuring Float

- Size of float depends on the dollar amount and the time delay
- Delay = mailing time + processing delay + availability delay
- Suppose you mail a check each month for $1,000 and it takes 3 days to reach its destination, 1 day to process, and 1 day before the bank makes the cash available
- What is the average daily float (assuming 30-day months)?
  - Method 1: (3+1+1)(1,000)/30 = 166.67
  - Method 2: (5/30)(1,000) + (25/30)(0) = 166.67

Example: Cost of Float

- Cost of float – opportunity cost of not being able to use the money
- Suppose the average daily float is $3 million with a weighted average delay of 5 days.
  - What is the total amount unavailable to earn interest?
    - 5*3 million = 15 million
  - What is the NPV of a project that could reduce the delay by 3 days if the cost is $8 million?
    - Immediate cash inflow = 3*3 million = 9 million
    - NPV = 9 – 8 = $1 million

Cash Collection

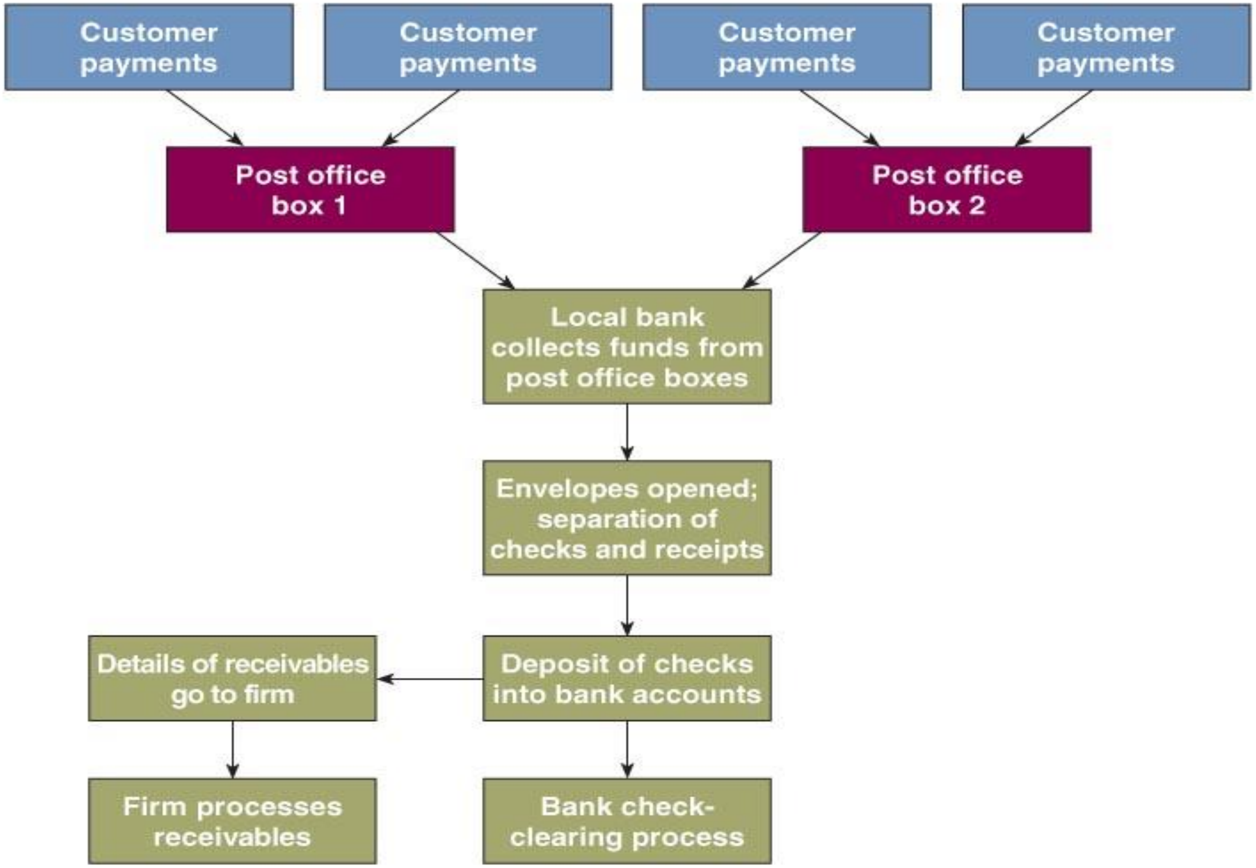


One of the goals of float management is to try to reduce the collection delay. There are several techniques that can reduce various parts of the delay.

Lockboxes & Cash Concentration

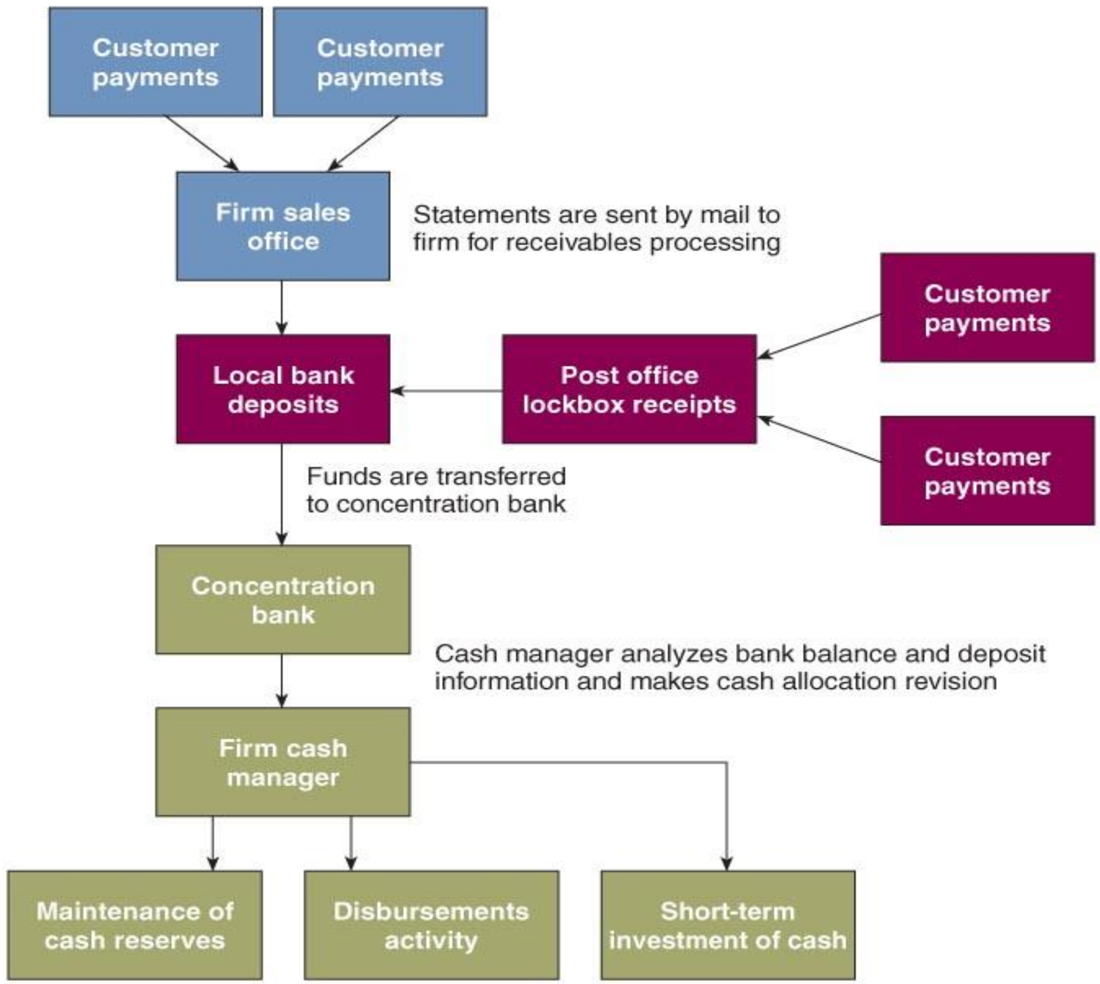
- Customer checks mailed to a P.O box
- Local bank picks up checks several times each day
  - Lockbox maintained by local bank
  - Checks deposited to firm's account
- Firms may have many lockbox arrangements around the country
  - Funds end up in multiple accounts
- Cash concentration = procedure to gather funds into firm's main accounts
- Reduces mailing and processing times

Overview of Lockbox Processing



The flow starts when a customer mails remittances to a post office box instead of to the corporation. Several times a day the bank collects the lockbox receipts from the post office. The checks are then put into the company bank accounts.

Lockboxes and Cash Concentration



Example: Accelerating Collections – Part I

- Your company does business nationally, and currently, all checks are sent to the headquarters in Tampa, FL. You are considering a lock-box system that will have checks processed in Phoenix, St. Louis and Philadelphia. The Tampa office will continue to process the checks it receives in house.
  - Collection time will be reduced by 2 days on average
  - Daily interest rate on T-bills = .01%
  - Average number of daily payments to each lockbox is 5,000
  - Average size of payment is $500
  - The processing fee is $.10 per check plus $10 to wire funds to a centralized bank at the end of each day.

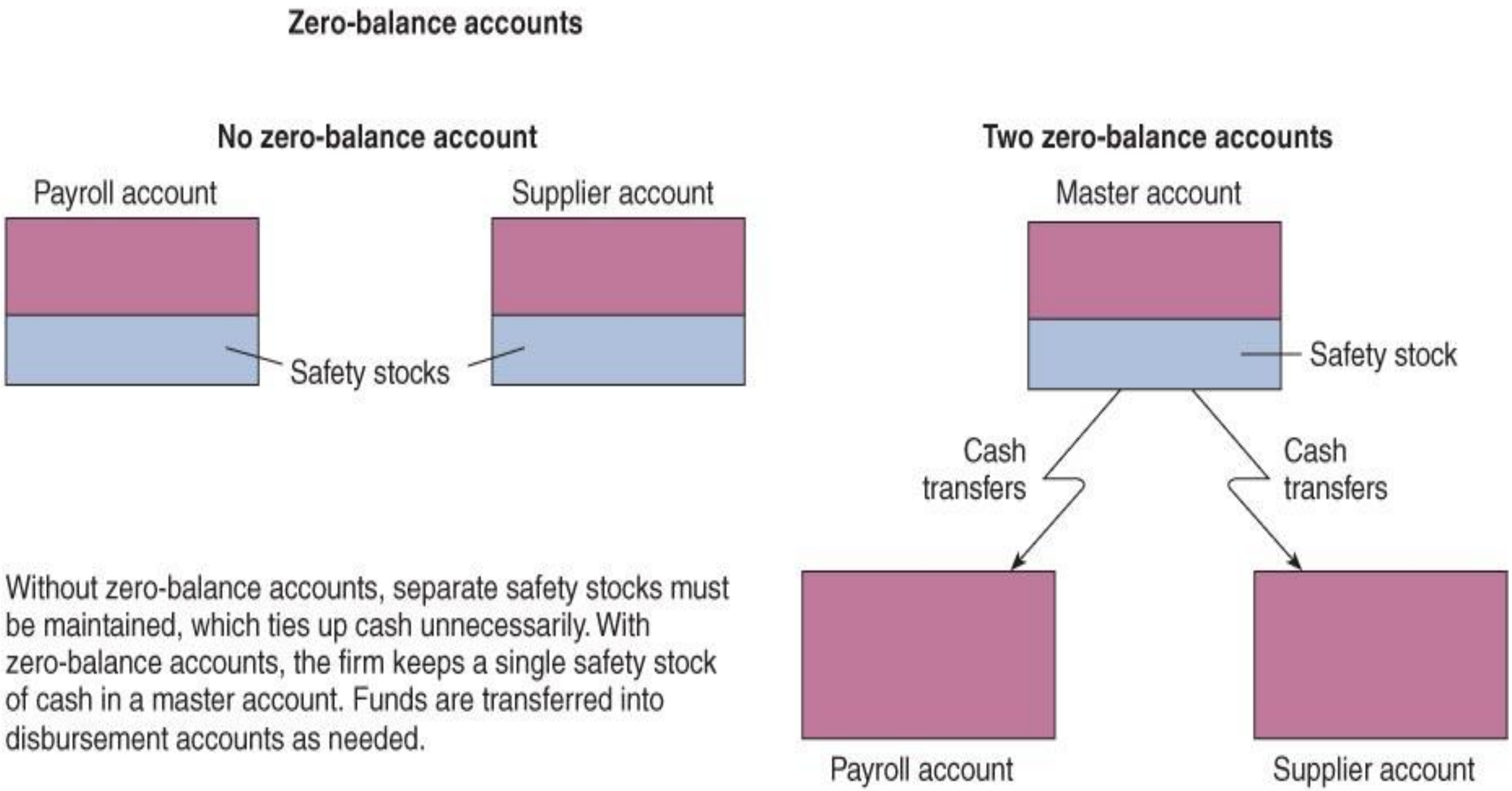
Example: Accelerating Collections – Part II

- Benefits
  - Average daily collections = 3(5,000)(500) = 7,500,000
  - Increased bank balance = 2(7,500,000) = 15,000,000
- Costs
  - Daily cost = .1(15,000) + 3*10 = 1,530
  - Present value of daily cost = 1,530/.0001 = 15,300,000
- NPV = 15,000,000 – 15,300,000 = -300,000
- The company should not accept this lock-box proposal

Cash Disbursements

- Slowing down payments can increase disbursement float – but it may not be ethical or optimal to do this
- Controlling disbursements
  - Zero-balance account
  - Controlled disbursement account

Zero-Balance Accounts

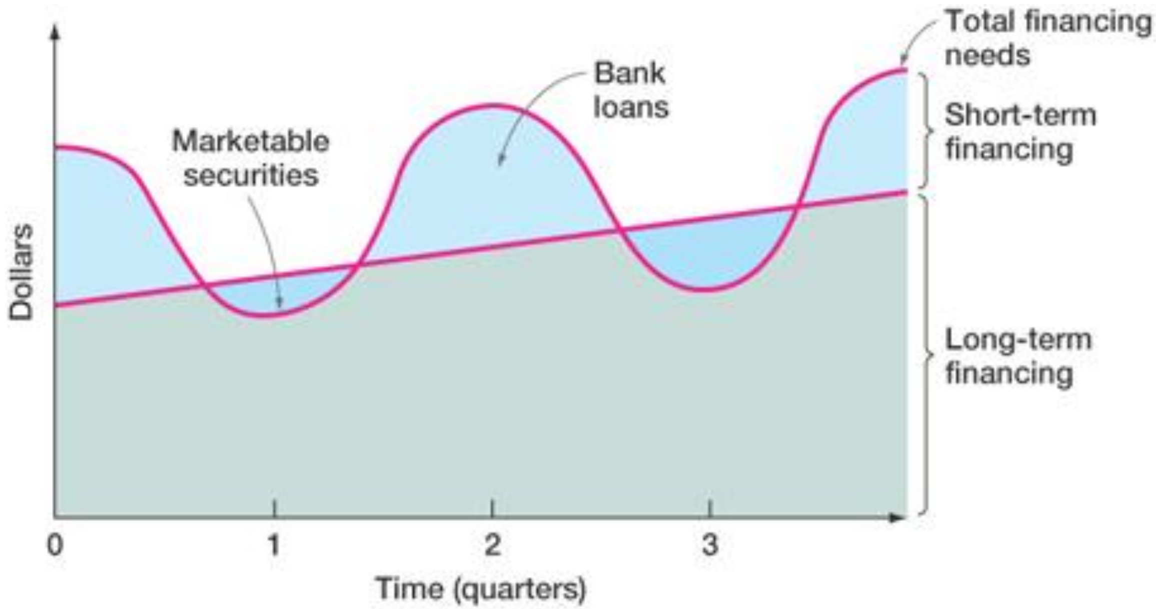


Without zero-balance accounts, separate safety stocks must be maintained, which ties up cash unnecessarily. With zero-balance accounts, the firm keeps a single safety stock of cash in a master account. Funds are transferred into disbursement accounts as needed.

Investing Cash

- Money market – financial instruments with an original maturity of one year or less
- Temporary Cash Surpluses
  - Seasonal or cyclical activities – buy marketable securities with seasonal surpluses, convert securities back to cash when deficits occur
  - Planned or possible expenditures – accumulate marketable securities in anticipation of upcoming expenses

Figure 27.6



Time 1: A surplus cash flow exists. Seasonal demand for assets is low. The surplus cash flow is invested in short-term marketable securities.

Time 2: A deficit cash flow exists. Seasonal demand for assets is high. The financial deficit is financed by the selling of marketable securities and by bank borrowing.

Characteristics of Short-Term Securities

- Maturity – firms often limit the maturity of short-term investments to 90 days to avoid loss of principal due to changing interest rates
- Default risk – avoid investing in marketable securities with significant default risk
- Marketability – ease of converting to cash
- Taxability – consider different tax characteristics when making a decision

Lecture 16

Credit and Inventory Management

Key Concepts and Skills

- Understand the key issues related to credit management
- Understand the impact of cash discounts
- Be able to evaluate a proposed credit policy
- Understand the components of credit analysis
- Understand the major components of inventory management
- Be able to use the EOQ model to determine optimal inventory ordering

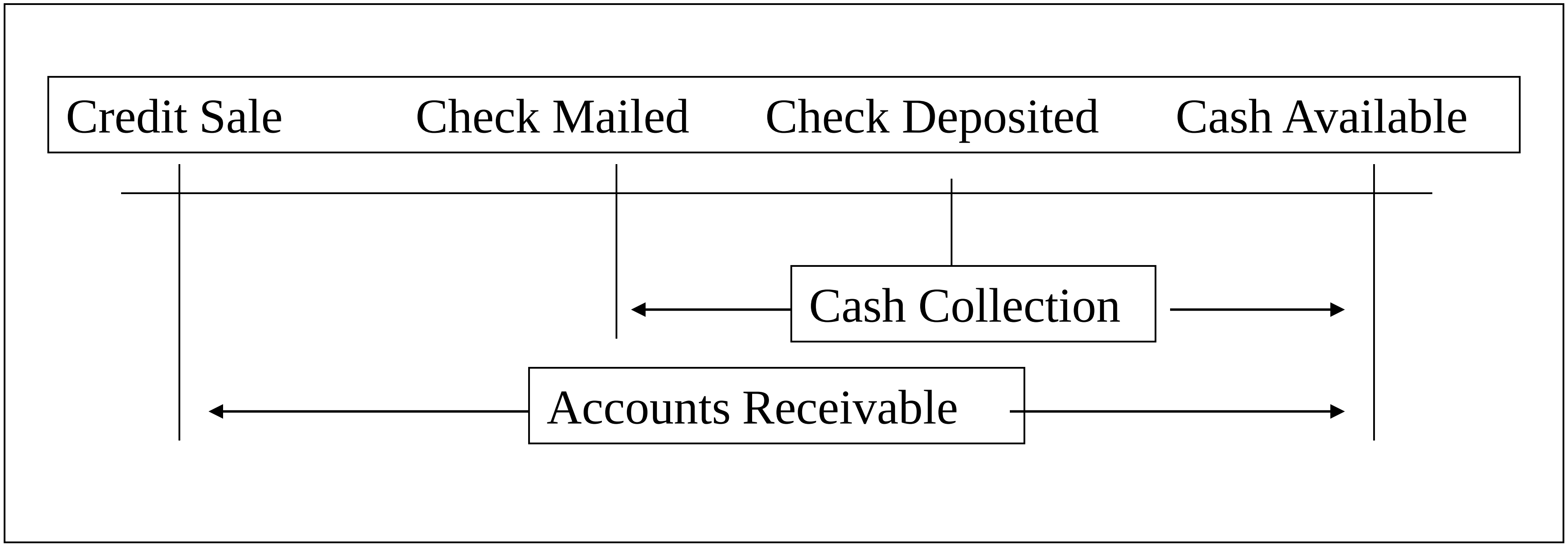
Credit Management: Key Issues

- Granting credit generally increases sales
- Costs of granting credit
  - Chance that customers will not pay
  - Financing receivables
- Credit management examines the trade-off between increased sales and the costs of granting credit

Components of Credit Policy

- Terms of sale
  - Credit period
  - Cash discount and discount period
  - Type of credit instrument
- Credit analysis – distinguishing between "good" customers that will pay and "bad" customers that will default
- Collection policy – effort expended on collecting receivables

The Cash Flows from Granting Credit



Terms of Sale

- Basic Form: 2/10 net 45
  - 2% discount if paid in 10 days
  - Total amount due in 45 days if discount not taken
- Buy $500 worth of merchandise with the credit terms given above
  - Pay $500(1 - .02) = $490 if you pay in 10 days
  - Pay $500 if you pay in 45 days

Example: Cash Discounts

- Finding the implied interest rate when customers do not take the discount
- Credit terms of 2/10 net 45
  - Period rate = 10/490 = 2 / 98 = 2.0408%
  - Period = (45 – 10) = 35 days
  - 365 / 35 = 10.4286 periods per year
- EAR = $(1.020408)^{10.4286} - 1 = 23.45\%$
- The company benefits when customers choose to forgo discounts

Credit Policy Effects

- Revenue Effects
  - Delay in receiving cash from sales
  - May be able to increase price
  - May increase total sales
- Cost Effects
  - Cost of the sale is still incurred even though the cash from the sale has not been received
  - Cost of debt – must finance receivables
  - Probability of nonpayment – some percentage of customers will not pay for products purchased
  - Cash discount – some customers will pay early and pay less than the full sales price

Example: Evaluating a Proposed Policy – Part I

- Your company is evaluating a switch from a cash only policy to a net 30 policy. The price per unit is \$100, and the variable cost per unit is \$40. The company currently sells 1,000 units per month. Under the proposed policy, the company expects to sell 1,050 units per month. The required monthly return is 1.5%.
- What is the NPV of the switch?
- Should the company offer credit terms of net 30?

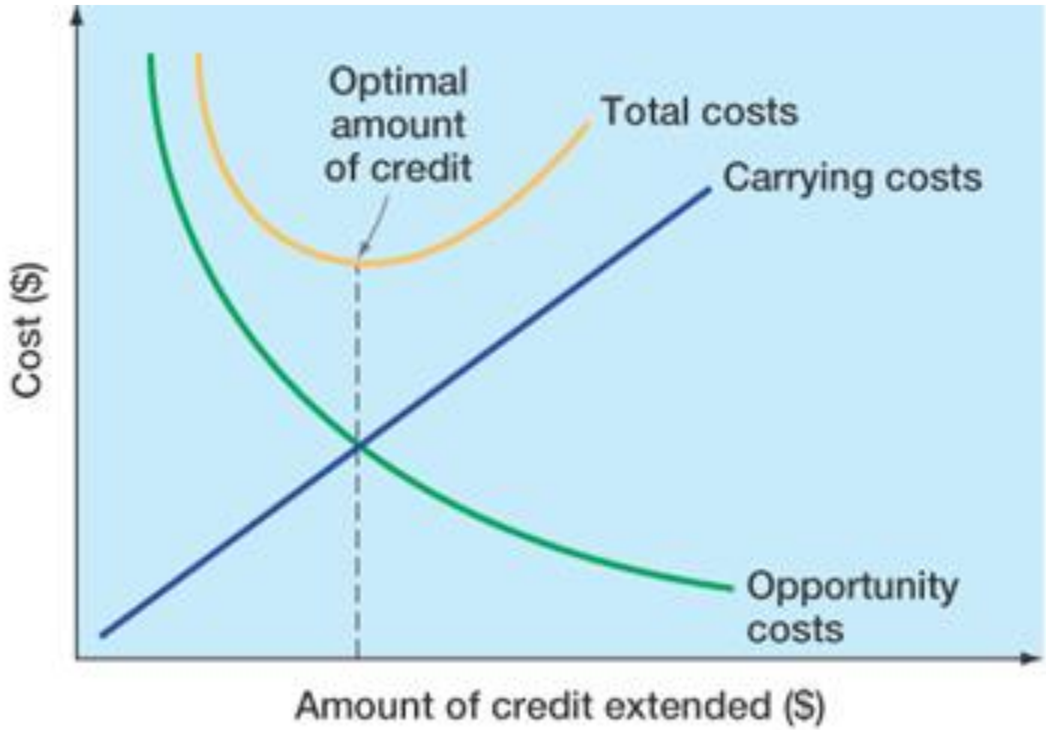
Example: Evaluating a Proposed Policy – Part II

- Incremental cash inflow
  - (100 – 40)(1,050 – 1,000) = 3,000
- Present value of incremental cash inflow
  - 3,000/.015 = 200,000
- Cost of switching
  - 100(1,000) + 40(1,050 – 1,000) = 102,000
- NPV of switching
  - 200,000 – 102,000 = 98,000
- Yes, the company should switch

Total Cost of Granting Credit

- Carrying costs
  - Required return on receivables
  - Losses from bad debts
  - Costs of managing credit and collections
- Shortage costs
  - Lost sales due to a restrictive credit policy
- Total cost curve
  - Sum of carrying costs and shortage costs
  - Optimal credit policy is where the total cost curve is minimized

Figure 28.1



Carrying costs are the cash flows that must be incurred when credit is granted. They are positively related to the amount of credit extended.

Opportunity costs are the lost sales resulting from refusing credit. These costs go down when credit is granted.

Credit Analysis

- Process of deciding which customers receive credit
- Gathering information
- Determining Creditworthiness
  - 5 Cs of Credit
  - Credit Scoring

Example: One-Time Sale

- $NPV = -v + (1 - \pi)P / (1 + R)$
- Your company is considering granting credit to a new customer. The variable cost per unit is $50; the current price is $110; the probability of default is 15%; and the monthly required return is 1%.
- $NPV = -50 + (1-.15)(110)/(1.01) = 42.57$
- What is the break-even probability?
  - $0 = -50 + (1 - \pi)(110)/(1.01)$
  - $\pi = .5409$ or 54.09%

Example: Repeat Customers

- NPV = -v + (1-π)(P – v)/R
- In the previous example, what is the NPV if we are looking at repeat business?
- NPV = -50 + (1-.15)(110 – 50)/.01 = 5,050
- Repeat customers can be very valuable (hence the importance of good customer service)
- It may make sense to grant credit to almost everyone once, as long as the variable cost is low relative to the price
- If a customer defaults once, you don't grant credit again

Credit Information

- Financial statements
- Credit reports with customer's payment history to other firms
- Banks
- Payment history with the company

Five Cs of Credit

- Character – willingness to meet financial obligations
- Capacity – ability to meet financial obligations out of operating cash flows
- Capital – financial reserves
- Collateral – assets pledged as security
- Conditions – general economic conditions related to customer's business

Collection Policy

- Monitoring receivables
  - Keep an eye on average collection period relative to your credit terms
  - Use an aging schedule to determine percentage of payments that are being made late
- Collection policy
  - Delinquency letter
  - Telephone call
  - Collection agency
  - Legal action

Inventory Management

- Inventory can be a large percentage of a firm's assets
- There can be significant costs associated with carrying too much inventory
- There can also be significant costs associated with not carrying enough inventory
- Inventory management tries to find the optimal trade-off between carrying too much inventory versus not enough

Types of Inventory

- Manufacturing firm
  - Raw material – starting point in production process
  - Work-in-progress
  - Finished goods – products ready to ship or sell
- Remember that one firm's "raw material" may be another firm's "finished goods"
- Different types of inventory can vary dramatically in terms of liquidity

Inventory Costs

- Carrying costs – range from 20 – 40% of inventory value per year
  - Storage and tracking
  - Insurance and taxes
  - Losses due to obsolescence, deterioration, or theft
  - Opportunity cost of capital
- Shortage costs
  - Restocking costs
  - Lost sales or lost customers
- Consider both types of costs, and minimize the total cost

Inventory Management – ABC

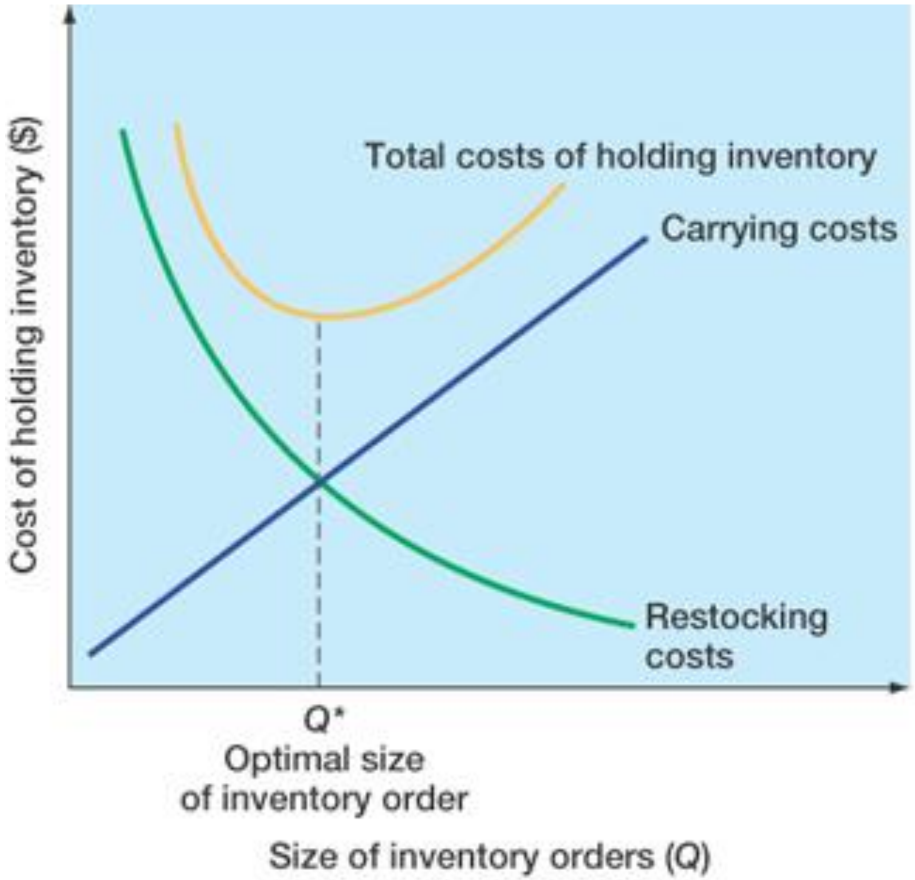
- Classify inventory by cost, demand, and need
- Those items that have substantial shortage costs should be maintained in larger quantities than those with lower shortage costs
- Generally maintain smaller quantities of expensive items
- Maintain a substantial supply of less expensive basic materials

EOQ Model

- The EOQ model minimizes the total inventory cost
- Total carrying cost = (average inventory) x (carrying cost per unit) = (Q/2)(CC)
- Total restocking cost = (fixed cost per order) x (number of orders) = F(T/Q)
- Total Cost = Total carrying cost + total restocking cost = (Q/2)(CC) + F(T/Q)

$$Q^* = \sqrt{\frac{2TF}{CC}}$$

Figure 28.3



Restocking costs are greatest when the firm holds a small quantity of inventory.
Carrying costs are greatest when there is a large quantity of inventory on hand.
Total costs are the sum of the carrying and restocking costs.

Example: EOQ

- Consider an inventory item that has carrying cost = \$1.50 per unit. The fixed order cost is \$50 per order, and the firm sells 100,000 units per year.
  - What is the economic order quantity?

$$Q^* = \sqrt{\frac{2(100{,}000)(50)}{1.50}} = 2{,}582$$

Extensions

- Safety stocks
  - Minimum level of inventory kept on hand
  - Increases carrying costs
- Reorder points
  - At what inventory level should you place an order?
  - Need to account for delivery time
- Derived-Demand Inventories
  - Materials Requirements Planning (MRP)
  - Just-in-Time Inventory

Lecture 2

Financial Statements Analysis and Financial Models

Key Concepts and Skills

- Know how to standardize financial statements for comparison purposes
- Know how to compute and interpret important financial ratios
- Be able to develop a financial plan using the percentage of sales approach
- Understand how capital structure and dividend policies affect a firm's ability to grow

3.1 Financial Statements Analysis

- Common-Size Balance Sheets
  - Compute all accounts as a percent of total assets
- Common-Size Income Statements
  - Compute all line items as a percent of sales
- Standardized statements make it easier to compare financial information, particularly as the company grows.
- They are also useful for comparing companies of different sizes, particularly within the same industry.

3.2 Ratio Analysis

- Ratios also allow for better comparison through time or between companies.
- As we look at each ratio, ask yourself:
  - How is the ratio computed?
  - What is the ratio trying to measure and why?
  - What is the unit of measurement?
  - What does the value indicate?
  - How can we improve the company's ratio?

Categories of Financial Ratios

- Short-term solvency or liquidity ratios
- Long-term solvency or financial leverage ratios
- Asset management or turnover ratios
- Profitability ratios
- Market value ratios

TABLE 3.1

PRUFROCK CORPORATION
Balance Sheets as of December 31, 2013 and 2014
($ in millions)

	2013	2014
Assets		
Current assets		
Cash	$ 84	$ 98
Accounts receivable	165	188
Inventory	393	422
Total	$ 642	$ 708
Fixed assets		
Net plant and equipment	$2,731	$2,880
Total assets	$3,373	$3,588
Liabilities and Owners' Equity		
Current liabilities		
Accounts payable	$ 312	$ 344
Notes payable	231	196
Total	$ 543	$ 540
Long-term debt	$ 531	$ 457
Owners' equity		
Common stock and paid-in surplus	$ 500	$ 550
Retained earnings	1,799	2,041
Total	$2,299	$2,591
Total liabilities and owners' equity	$3,373	$3,588

TABLE 3.2

PRUFROCK CORPORATION
Common-Size Balance Sheets
December 31, 2013 and 2014

	2013	2014	Change
Assets			
Current assets			
Cash	2.5%	2.7%	+ .2%
Accounts receivable	4.9	5.2	+ .3
Inventory	11.7	11.8	+ .1
Total	19.1	19.7	+ .7
Fixed assets			
Net plant and equipment	80.9	80.3	− .7
Total assets	100.0%	100.0%	0%
Liabilities and Owners' Equity			
Current liabilities			
Accounts payable	9.2%	9.6%	+ .3%
Notes payable	6.8	5.5	− 1.4
Total	16.0	15.1	− 1.0
Long-term debt	15.7	12.7	− 3.0
Owners' equity			
Common stock and paid-in surplus	14.8	15.3	+ .5
Retained earnings	53.3	56.9	+ 3.5
Total	68.1	72.2	+ 4.1
Total liabilities and owners' equity	100.0%	100.0%	0%

TABLE 3.3

PRUFROCK CORPORATION
2014 Income Statement
($ in millions)

Sales		$2,311
Cost of goods sold		1,344
Depreciation		276
Earnings before interest and taxes		$ 691
Interest paid		141
Taxable income		$ 550
Taxes (34%)		187
Net income		$ 363
Dividends	$121	
Addition to retained earnings	242	

TABLE 3.4

PRUFROCK CORPORATION Common-Size Income Statement 2014		
Sales		100.0%
Cost of goods sold		58.2
Depreciation		11.9
Earnings before interest and taxes		29.9
Interest paid		6.1
Taxable income		23.8
Taxes (34%)		8.1
Net income		15.7%
Dividends	5.2%	
Addition to retained earnings	10.5	

TABLE 3.5 Common financial ratios

I. Short-term solvency, or liquidity, ratios

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$\text{Quick ratio} = \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}}$$

$$\text{Cash ratio} = \frac{\text{Cash}}{\text{Current liabilities}}$$

II. Long-term solvency, or financial leverage, ratios

$$\text{Total debt ratio} = \frac{\text{Total assets} - \text{Total equity}}{\text{Total assets}}$$

Debt-equity ratio = Total debt/Total equity

Equity multiplier = Total assets/Total equity

$$\text{Times interest earned ratio} = \frac{\text{EBIT}}{\text{Interest}}$$

$$\text{Cash coverage ratio} = \frac{\text{EBIT} + \text{Depreciation}}{\text{Interest}}$$

III. Asset utilization, or turnover, ratios

$$\text{Inventory turnover} = \frac{\text{Cost of goods sold}}{\text{Inventory}}$$

$$\text{Days' sales in inventory} = \frac{\text{365 days}}{\text{Inventory turnover}}$$

$$\text{Receivables turnover} = \frac{\text{Sales}}{\text{Accounts receivable}}$$

$$\text{Days' sales in receivables} = \frac{\text{365 days}}{\text{Receivables turnover}}$$

$$\text{Total asset turnover} = \frac{\text{Sales}}{\text{Total assets}}$$

$$\text{Capital intensity} = \frac{\text{Total assets}}{\text{Sales}}$$

IV. Profitability ratios

$$\text{Profit margin} = \frac{\text{Net Income}}{\text{Sales}}$$

$$\text{Return on assets (ROA)} = \frac{\text{Net income}}{\text{Total assets}}$$

$$\text{Return on equity (ROE)} = \frac{\text{Net income}}{\text{Total equity}}$$

$$\text{ROE} = \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}}$$

V. Market value ratios

$$\text{Price-earnings ratio} = \frac{\text{Price per share}}{\text{Earnings per share}}$$

$$\text{Price-sales ratio} = \frac{\text{Price per share}}{\text{Sales per share}}$$

$$\text{Market-to-book ratio} = \frac{\text{Market value per share}}{\text{Book value per share}}$$

Computing Liquidity Ratios

- Current Ratio = CA / CL
  - 708 / 540 = 1.31 times
- Quick Ratio = (CA – Inventory) / CL
  - (708 - 422) / 540 = .53 times
- Cash Ratio = Cash / CL
  - 98 / 540 = .18 times

  - Slide 5

Computing Leverage Ratios

- Total Debt Ratio = (TA – TE) / TA
  - (3588 - 2591) / 3588 = 28%
- Debt/Equity = TD / TE
  - (3588 – 2591) / 2591 = 38.5%
- Equity Multiplier = TA / TE = 1 + D/E
  - 1 + .385 = 1.385

  - Slide 5

Computing Coverage Ratios

- Times Interest Earned = EBIT / Interest
  - 691 / 141 = 4.9 times
- Cash Coverage = (EBIT + Depreciation + Amortization) / Interest
  - (691 + 276) / 141 = 6.9 times

  - Slide 7

Computing Inventory Ratios

- Inventory Turnover = Cost of Goods Sold / Inventory
  - 1344 / 422 = 3.2 times
- Days' Sales in Inventory = 365 / Inventory Turnover
  - 365 / 3.2 = 114 days

  - Slide 5

Computing Receivables Ratios

- Receivables Turnover = Sales / Accounts Receivable
  - 2311 / 188 = 12.3 times
- Days' Sales in Receivables = 365 / Receivables Turnover
  - 365 / 12.3 = 30 days

  - Slide 5

Computing Total Asset Turnover

- Total Asset Turnover = Sales / Total Assets
  - 2311 / 3588 = .64 times
  - It is not unusual for TAT < 1, especially if a firm has a large amount of fixed assets.

  - Slide 5

Computing Profitability Measures

- Profit Margin = Net Income / Sales
  - 363 / 2311 = 15.7%
- Return on Assets (ROA) = Net Income / Total Assets
  - 363 / 3588 = 10.1%
- Return on Equity (ROE) = Net Income / Total Equity
  - 363 / 2591 = 14.0%
- EBITDA Margin = EBITDA / Sales
  - 967 / 2311 = 41.8%

  - Slide 7

Computing Market Value Measures

- Market Capitalization = \$88 per share x 33 million shares = \$2,904 million
- PE Ratio = Price per share / Earnings per share
  - 88 / 11 = 8 times
- Market-to-book ratio = market value per share / book value per share
  - 88 / (2591 / 33) = 1.12 times
- Enterprise Value (EV) = Market capitalization + Market value of interest bearing debt – cash
  - 2904 + (196 + 457) – 98 = \$3,459
- EV Multiple = EV / EBITDA
  - 3459 / 967 = 3.6 times

  - Slide 5

Using Financial Statements

- Ratios are not very helpful by themselves: they need to be compared to something
- Time-Trend Analysis
  - Used to see how the firm's performance is changing through time
- Peer Group Analysis
  - Compare to similar companies or within industries
  - SIC and NAICS codes

3.3 The DuPont Identity

- ROE = NI / TE
- Multiply by 1 and then rearrange:
  - ROE = (NI / TE) (TA / TA)
  - ROE = (NI / TA) (TA / TE) = ROA * EM
- Multiply by 1 again and then rearrange:
  - ROE = (NI / TA) (TA / TE) (Sales / Sales)
  - ROE = (NI / Sales) (Sales / TA) (TA / TE)
  - ROE = PM * TAT * EM

Using the DuPont Identity

- ROE = PM * TAT * EM
  - Profit margin is a measure of the firm's operating efficiency – how well it controls costs.
  - Total asset turnover is a measure of the firm's asset use efficiency – how well it manages its assets.
  - Equity multiplier is a measure of the firm's financial leverage.

Calculating the DuPont Identity

- ROA = 10.1% and EM = 1.39
  - ROE = 10.1% * 1.385 = 14.0%
- PM = 15.7% and TAT = 0.64
  - ROE = 15.7% * 0.64 * 1.385 = 14.0%

Potential Problems

- There is no underlying theory, so there is no way to know which ratios are most relevant.
- Benchmarking is difficult for diversified firms.
- Globalization and international competition makes comparison more difficult because of differences in accounting regulations.
- Firms use varying accounting procedures.
- Firms have different fiscal years.
- Extraordinary, or one-time, events

3.4 Financial Models

- Investment in new assets – determined by capital budgeting decisions
- Degree of financial leverage – determined by capital structure decisions
- Cash paid to shareholders – determined by dividend policy decisions
- Liquidity requirements – determined by net working capital decisions

Financial Planning Ingredients

- Sales Forecast – many cash flows depend directly on the level of sales (often estimate sales growth rate)
- Pro Forma Statements – setting up the plan as projected (pro forma) financial statements allows for consistency and ease of interpretation
- Asset Requirements – the additional assets that will be required to meet sales projections
- Financial Requirements – the amount of financing needed to pay for the required assets
- Plug Variable – determined by management decisions about what type of financing will be used (makes the balance sheet balance)
- Economic Assumptions – explicit assumptions about the coming economic environment

Percent of Sales Approach

- Some items vary directly with sales, others do not.
- Income Statement
  - Costs may vary directly with sales - if this is the case, then the profit margin is constant
  - Depreciation and interest expense may not vary directly with sales – if this is the case, then the profit margin is not constant
  - Dividends are a management decision and generally do not vary directly with sales – this affects additions to retained earnings

Percent of Sales Approach

- Balance Sheet
  - Initially assume all assets, including fixed, vary directly with sales.
  - Accounts payable also normally vary directly with sales.
  - Notes payable, long-term debt, and equity generally do not vary with sales because they depend on management decisions about capital structure.
  - The change in the retained earnings portion of equity will come from the dividend decision.
- External Financing Needed (EFN)
  - The difference between the forecasted increase in assets and the forecasted increase in liabilities and equity.

ROSENGARTEN CORPORATION

Income Statement

Sales	$	1,000
Costs		800
Taxable income	$	200
Taxes (34%)		68
Net income	$	132
Dividends	$	44
Addition to		
retained earnings	$	88

ROSENGARTEN CORPORATION

Pro forma

Income Statement

Sales	$	1,250
Costs		1,000
Taxable income	$	250
Taxes		85
Net income	$	165

ROSENGARTEN CORPORATION

Balance Sheet

Current assets			Current liabilities		
Cash	$	160	Accounts payable	$	300
Accounts receivable		440	Notes payable		100
Inventory		600	Total	$	400
Total	$	1,200	Long-term debt	$	800
			Owners' equity		
Fixed assets			Common stock and		
Net plant and equipment	$	1,800	paid-in surplus	$	800
			Retained earnings		1,000
			Total	$	1,800
Total assets	$	3,000	Total liabilities and equity	$	3,000

ROSENGARTEN CORPORATION

Percentage of sales

Balance Sheet

Current assets		Current liabilities	
Cash	16%	Accounts payable	30%
Accounts receivable	44%	Notes payable	N/A
Inventory	60%	Total	N/A
Total	120%	Long-term debt	N/A
		Owners' equity	
Fixed assets		Common stock and	
Net plant and equipment	180%	paid-in surplus	N/A
		Retained earnings	N/A
		Total	N/A
Total assets	300%	Total liabilities and equity	N/A

ROSENGARTEN CORPORATION

Pro forma
Balance Sheet

Current assets			Current liabilities		
Cash	$	200	Accounts payable	$	375
Accounts receivable		550	Notes payable		100
Inventory		750	Total	$	475
Total	$	1,500	Long-term debt	$	800
			Owners' equity		
Fixed assets			Common stock and		
Net plant and equipment	$	2,250	paid-in surplus	$	800
			Retained earnings		1,110
			Total	$	1,910
Total assets	$	3,750	Total liabilities and equity	$	3,185

Percent of Sales and EFN

- External Financing Needed (EFN) can also be calculated as:

$$\left(\frac{\text{Assets}}{\text{Sales}}\right)\times \Delta\text{Sales} - \frac{\text{Spon Liab}}{\text{Sales}}\times \Delta\text{Sales} - (PM \times \text{Projected Sales})\times(1-d)$$

$$= (3\times 250) - (0.3\times 250) - (0.13\times 1250\times 0.667)$$

$$= \$565$$

3.5 External Financing and Growth

- At low growth levels, internal financing (retained earnings) may exceed the required investment in assets.
- As the growth rate increases, the internal financing will not be enough, and the firm will have to go to the capital markets for financing.
- Examining the relationship between growth and external financing required is a useful tool in financial planning.

HOFFMAN COMPANY		
Income Statement		
Sales	$	500
Costs		400
Taxable income	$	100
Taxes		34
Net income	$	66
Dividends	$	22
Addition to retained earnings	$	44

HOFFMAN COMPANY

Balance Sheet

Current assets	$	200	Total debt	$	250
Net fixed assets		300	Owners' equity		250
Total assets	$	500	Total liabilities and equity	$	500

The Internal Growth Rate

- The internal growth rate tells us how much the firm can grow using retained earnings as the only source of financing.
- Using the information from the Hoffman Co.
  - ROA = 66 / 500 = .132
  - b = 44/ 66 = .667

$$\text{Internal Growth Rate} = \frac{\text{ROA} \times \text{b}}{1 - \text{ROA} \times \text{b}}$$

$$= \frac{.132 \times .667}{1 - .132 \times .667} = .0965$$

$$= 9.65\%$$

The Sustainable Growth Rate

- The sustainable growth rate tells us how much the firm can grow by using internally generated funds and issuing debt to maintain a constant debt ratio.
- Using the Hoffman Co.
  - ROE = 66 / 250 = .264
  - b = .667

$$\text{Sustainable Growth Rate} = \frac{\text{ROE} \times \text{b}}{1 - \text{ROE} \times \text{b}}$$

$$= \frac{.264 \times .667}{1 - .264 \times .667} = .214$$

$$= 21.4\%$$

Determinants of Growth

- Profit margin – operating efficiency
- Total asset turnover – asset use efficiency
- Financial leverage – choice of optimal debt ratio
- Dividend policy – choice of how much to pay to shareholders versus reinvesting in the firm

3.6 Some Caveats

- Financial planning models do not indicate which financial polices are the best.
- Models are simplifications of reality, and the world can change in unexpected ways.
- Without some sort of plan, the firm may find itself adrift in a sea of change without a rudder for guidance.

Lecture 3

Discounted Cash Flow Valuation (Review)
Net Present Value and Other Investment Rules

4.1 The One-Period Case

- If you were to invest \$10,000 at 5-percent interest for one year, your investment would grow to \$10,500.

\$500 would be interest (\$10,000 × .05)
<u>\$10,000</u> is the principal repayment (\$10,000 × 1)
\$10,500 is the total due. It can be calculated as:

$$\$10{,}500 = \$10{,}000 \times (1.05)$$

- The total amount due at the end of the investment is call the *Future Value* (*FV*).

Future Value

- In the one-period case, the formula for *FV* can be written as:

$$FV = C_0 \times (1 + r)$$

Where C_0 is cash flow today (time zero), and
r is the appropriate interest rate.

Present Value

- If you were to be promised \$10,000 due in one year when interest rates are 5-percent, your investment would be worth \$9,523.81 in today's dollars.

$$\$9{,}523.81 = \frac{\$10{,}000}{1.05}$$

The amount that a borrower would need to set aside today to be able to meet the promised payment of \$10,000 in one year is called the *Present Value* (*PV*).

Note that $\$10{,}000 = \$9{,}523.81 \times (1.05)$.

Present Value

- In the one-period case, the formula for *PV* can be written as:

$$PV = \frac{C_1}{1+r}$$

Where C_1 is cash flow at date 1, and

r is the appropriate interest rate.

Net Present Value

- The Net Present Value (*NPV*) of an investment is the present value of the expected cash flows, less the cost of the investment.
- Suppose an investment that promises to pay $10,000 in one year is offered for sale for $9,500. Your interest rate is 5%. Should you buy?

Net Present Value

$$NPV = -\$9{,}500 + \frac{\$10{,}000}{1.05}$$

$$NPV = -\$9{,}500 + \$9{,}523.81$$

$$NPV = \$23.81$$

The present value of the cash inflow is greater than the cost. In other words, the Net Present Value is positive, so the investment should be purchased.

Net Present Value

In the one-period case, the formula for *NPV* can be written as:

$$NPV = -Cost + PV$$

If we had *not* undertaken the positive *NPV* project considered on the last slide, and instead invested our \$9,500 elsewhere at 5 percent, our *FV* would be less than the \$10,000 the investment promised, and we would be worse off in *FV* terms :

$$\$9{,}500 \times (1.05) = \$9{,}975 < \$10{,}000$$

4.2 The Multiperiod Case

- The general formula for the future value of an investment over many periods can be written as:

$$FV = C_0 \times (1 + r)^T$$

Where

C_0 is cash flow at date 0,

r is the appropriate interest rate, and

T is the number of periods over which the cash is invested.

Future Value

- Suppose a stock currently pays a dividend of \$1.10, which is expected to grow at 40% per year for the next five years.
- What will the dividend be in five years?

$$FV = C_0 \times (1 + r)^T$$

$$\$5.92 = \$1.10 \times (1.40)^5$$

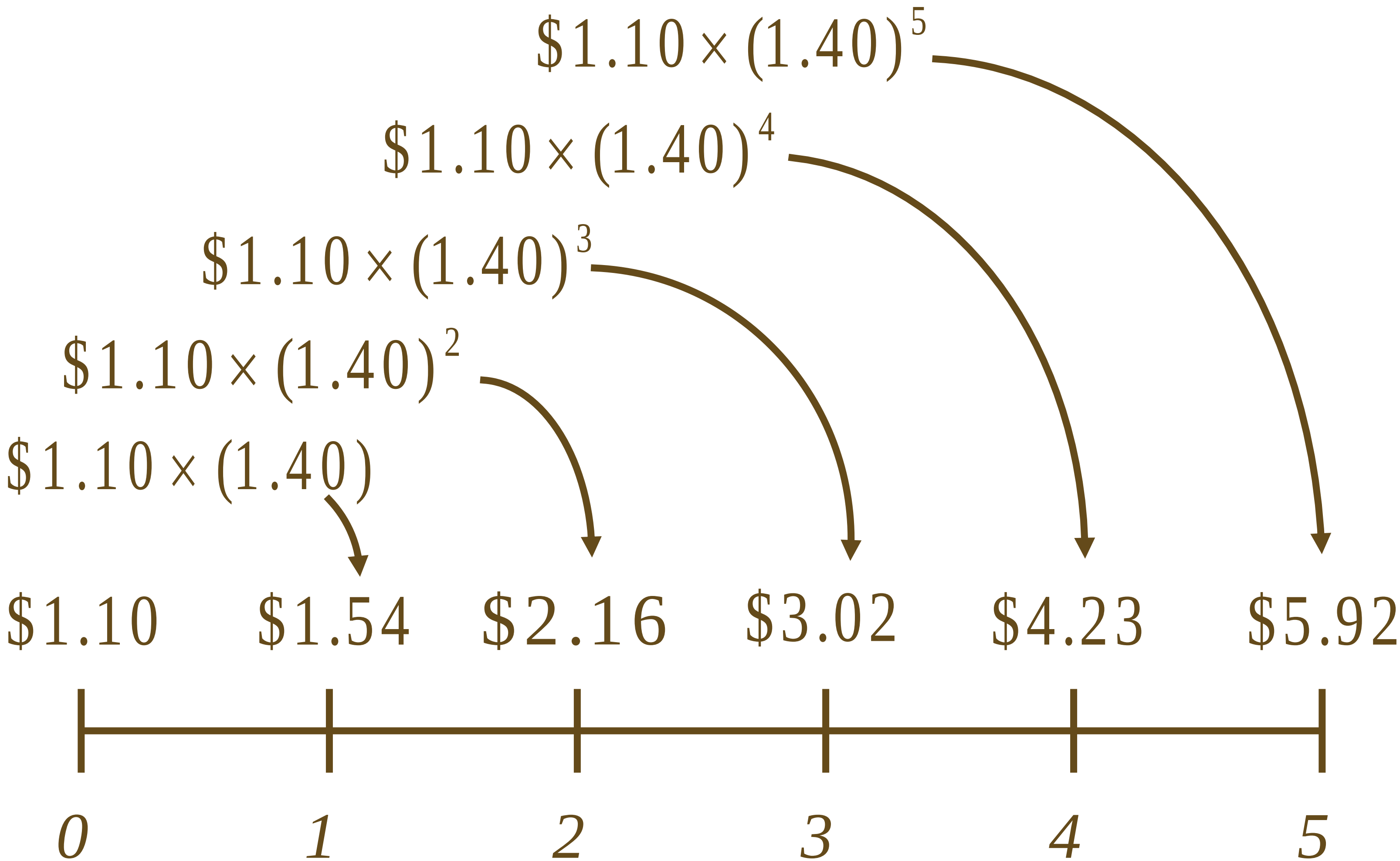
Future Value and Compounding

- Notice that the dividend in year five, \$5.92, is considerably higher than the sum of the original dividend plus five increases of 40-percent on the original \$1.10 dividend:

$$\$5.92 > \$1.10 + 5 \times [\$1.10 \times .40] = \$3.30$$

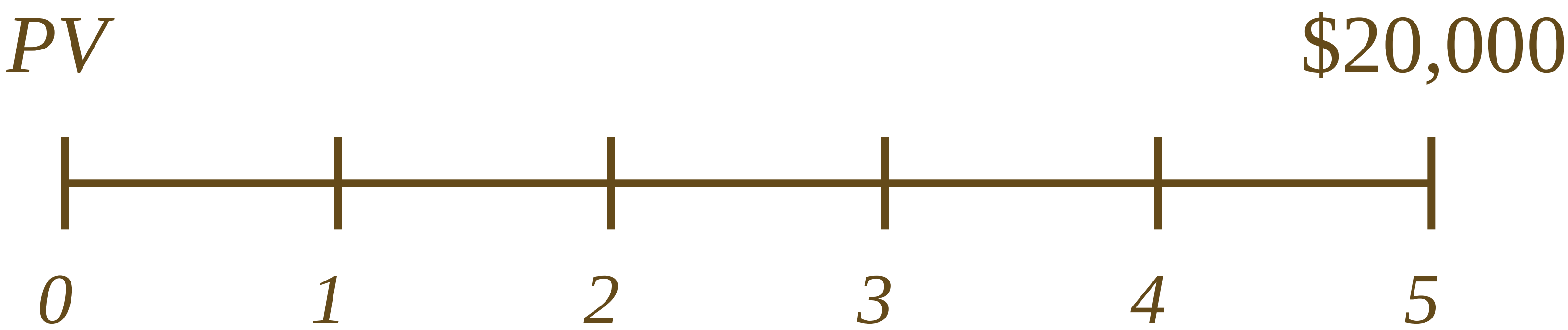
This is due to *compounding*.

Future Value and Compounding



Present Value and Discounting

- How much would an investor have to set aside today in order to have $20,000 five years from now if the current rate is 15%?



$$\$9{,}943.53 = \frac{\$20{,}000}{(1.15)^5}$$

4.5 Finding the Number of Periods

If we deposit $5,000 today in an account paying 10%, how long does it take to grow to $10,000?

$$FV = C_0 \times (1+r)^T \qquad \$10{,}000 = \$5{,}000 \times (1.10)^T$$

$$(1.10)^T = \frac{\$10{,}000}{\$5{,}000} = 2$$

$$\ln(1.10)^T = \ln(2)$$

$$T = \frac{\ln(2)}{\ln(1.10)} = \frac{0.6931}{0.0953} = 7.27 \text{ years}$$

What Rate Is Enough?

Assume the total cost of a college education will be \$50,000 when your child enters college in 12 years. You have \$5,000 to invest today. What rate of interest must you earn on your investment to cover the cost of your child's education?

About 21.15%.

$$FV = C_0 \times (1 + r)^T \qquad \$50{,}000 = \$5{,}000 \times (1 + r)^{12}$$

$$(1 + r)^{12} = \frac{\$50{,}000}{\$5{,}000} = 10 \qquad (1 + r) = 10^{1/12}$$

$$r = 10^{1/12} - 1 = 1.2115 - 1 = .2115$$

Excel Spreadsheet Functions

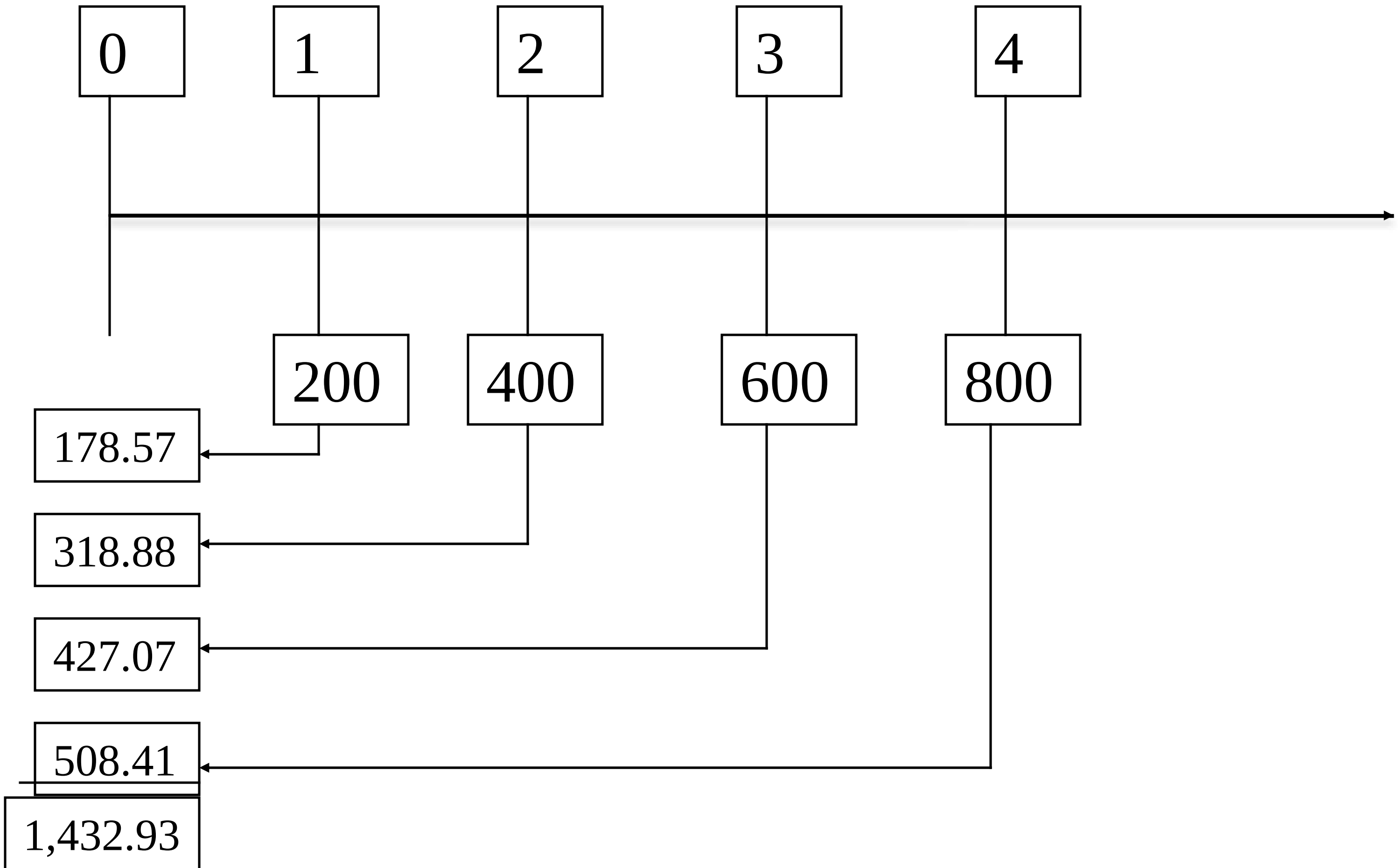
- Excel TVM (Time Value of Money) functions:
  =FV(rate,nper,pmt,pv)
  =PV(rate,nper,pmt,fv)
  =RATE(nper,pmt,pv,fv)
  =NPER(rate,pmt,pv,fv)
- Use the formula icon (f_x) when you can't remember the exact formula
- Click on the Excel icon to open a spreadsheet containing four different examples.

4-15

Multiple Cash Flows

- Consider an investment that pays $200 one year from now, with cash flows increasing by $200 per year through year 4. If the interest rate is 12%, what is the present value of this stream of cash flows?
- If the issuer offers this investment for $1,500, should you purchase it?

Multiple Cash Flows



Present Value < Cost → Do Not Purchase

4.3 Compounding Periods

Compounding an investment *m* times a year for *T* years provides for future value of wealth:

$$FV = C_0 \times \left(1 + \frac{r}{m}\right)^{m \times T}$$

Compounding Periods

- For example, if you invest $50 for 3 years at 12% compounded semi-annually, your investment will grow to:

$$FV = \$50 \times \left(1 + \frac{.12}{2}\right)^{2\times3} = \$50 \times (1.06)^6 = \$70.93$$

Effective Annual Rates of Interest

A reasonable question to ask in the above example is "what is the effective *annual* rate of interest on that investment?"

$$FV = \$50 \times (1 + \frac{.12}{2})^{2\times 3} = \$50 \times (1.06)^{6} = \$70.93$$

The Effective Annual Rate (EAR) of interest is the annual rate that would give us the same end-of-investment wealth after 3 years:

$$\$50 \times (1 + EAR)^{3} = \$70.93$$

Effective Annual Rates of Interest

$$FV = \$50 \times (1 + EAR)^3 = \$70.93$$

$$(1 + EAR)^3 = \frac{\$70.93}{\$50}$$

$$EAR = \left(\frac{\$70.93}{\$50}\right)^{1/3} - 1 = .1236$$

So, investing at 12.36% compounded annually is the same as investing at 12% compounded semi-annually.

$$(1+r)^T = (1.06)^{2T}$$

Effective Annual Rates of Interest

- Find the Effective Annual Rate (EAR) of an 18% APR loan that is compounded monthly.
- What we have is a loan with a monthly interest rate rate of 1½%.
- This is equivalent to a loan with an annual interest rate of 19.56%.

$$\left(1+\frac{r}{m}\right)^{m} = \left(1+\frac{.18}{12}\right)^{12} = (1.015)^{12} = 1.1956$$

Continuous Compounding

- The general formula for the future value of an investment compounded continuously over many periods can be written as:

$$FV = C_0 \times e^{rT}$$

Where

C_0 is cash flow at date 0,

r is the stated annual interest rate,

T is the number of years, and

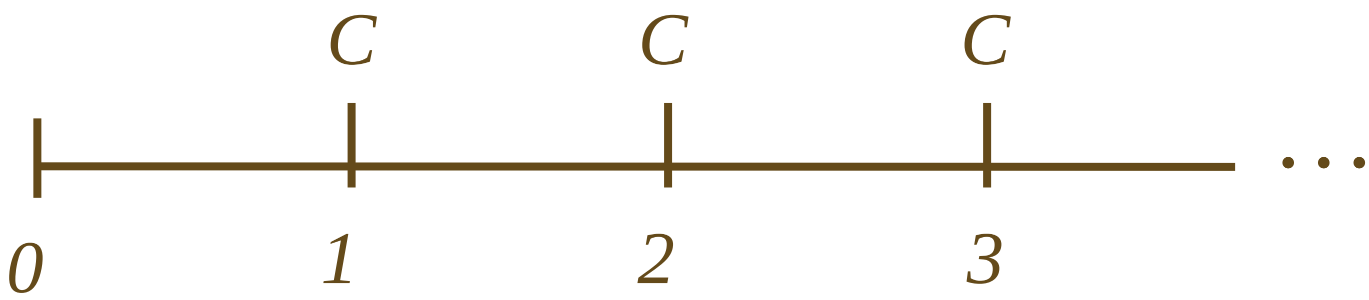
e is a transcendental number approximately equal to 2.718. e^x is a key on your calculator.

4.4 Simplifications

- Perpetuity
  - A constant stream of cash flows that lasts forever
- Growing perpetuity
  - A stream of cash flows that grows at a constant rate forever
- Annuity
  - A stream of constant cash flows that lasts for a fixed number of periods
- Growing annuity
  - A stream of cash flows that grows at a constant rate for a fixed number of periods

Perpetuity

A constant stream of cash flows that lasts forever



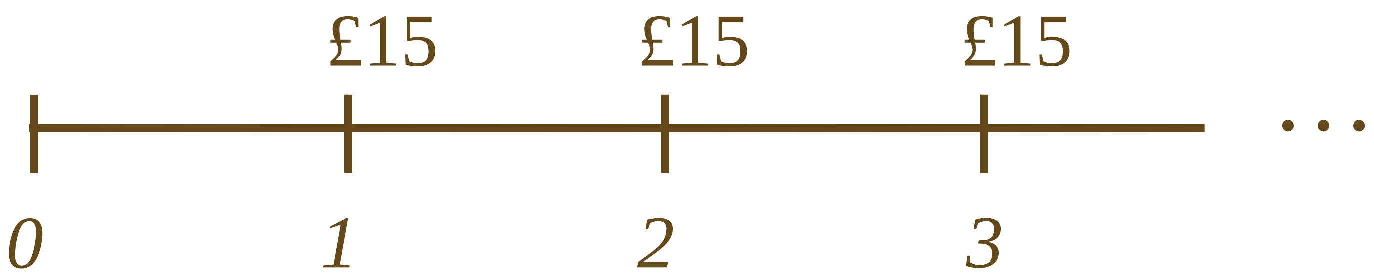
$$PV = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots$$

$$PV = \frac{C}{r}$$

Perpetuity: Example

What is the value of a British consol that promises to pay £15 every year for ever?

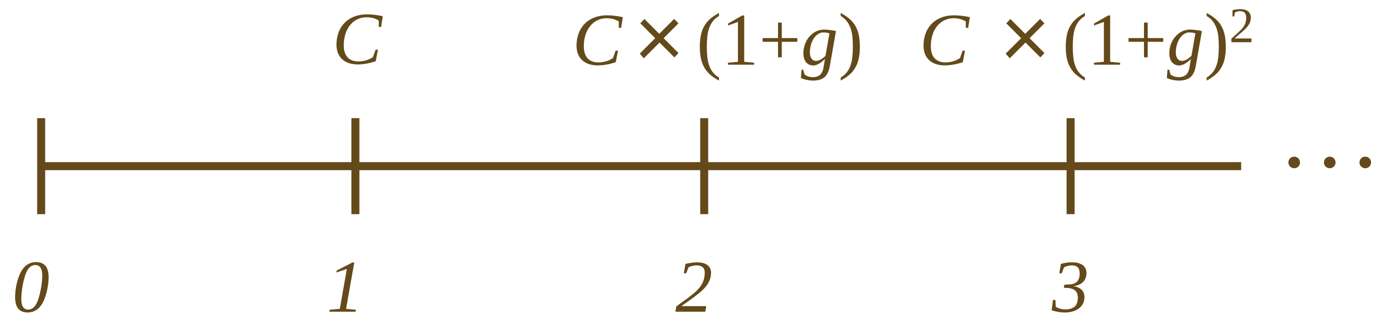
The interest rate is 10-percent.



$$PV = \frac{£15}{.10} = £150$$

Growing Perpetuity

A growing stream of cash flows that lasts forever



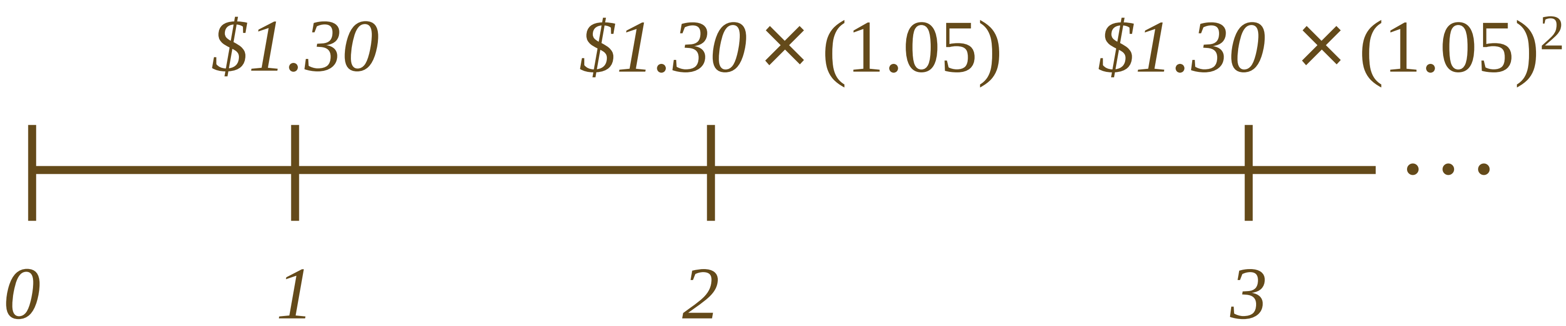
$$PV = \frac{C}{(1+r)} + \frac{C \times (1+g)}{(1+r)^2} + \frac{C \times (1+g)^2}{(1+r)^3} + \cdots$$

$$PV = \frac{C}{r-g}$$

Growing Perpetuity: Example

The expected dividend next year is \$1.30, and dividends are expected to grow at 5% forever.

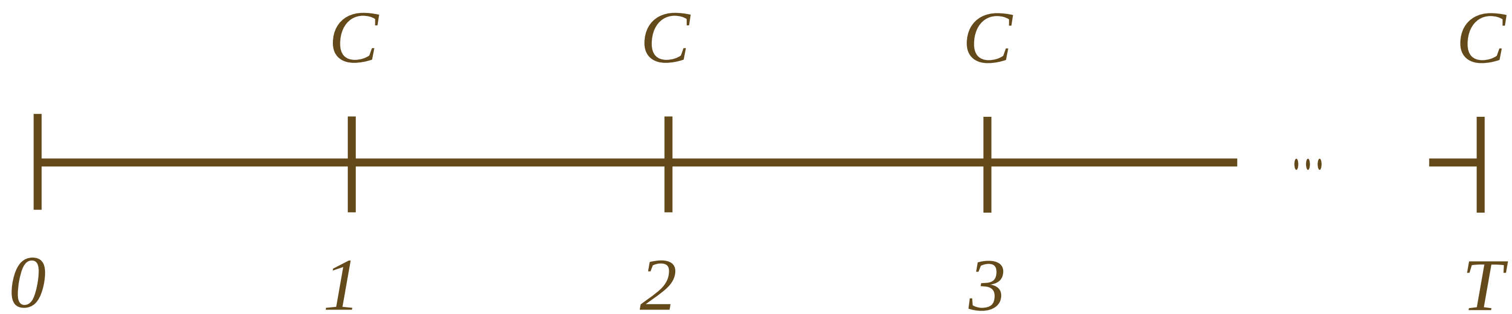
If the discount rate is 10%, what is the value of this promised dividend stream?



$$PV = \frac{\$1.30}{.10 - .05} = \$26.00$$

Annuity

A constant stream of cash flows with a fixed maturity

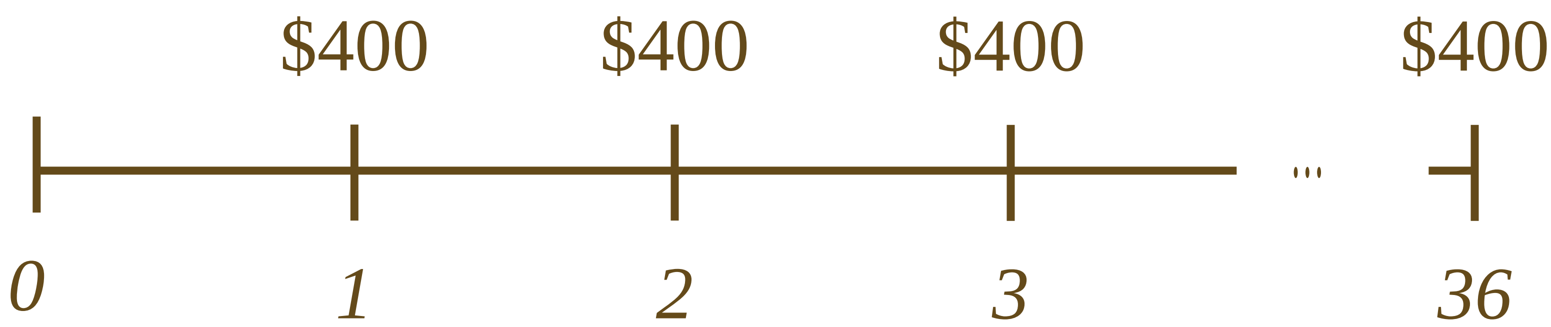


$$PV = \frac{C}{(1+r)} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} + \cdots \frac{C}{(1+r)^T}$$

$$PV = \frac{C}{r}\left[1 - \frac{1}{(1+r)^T}\right]$$

Annuity: Example

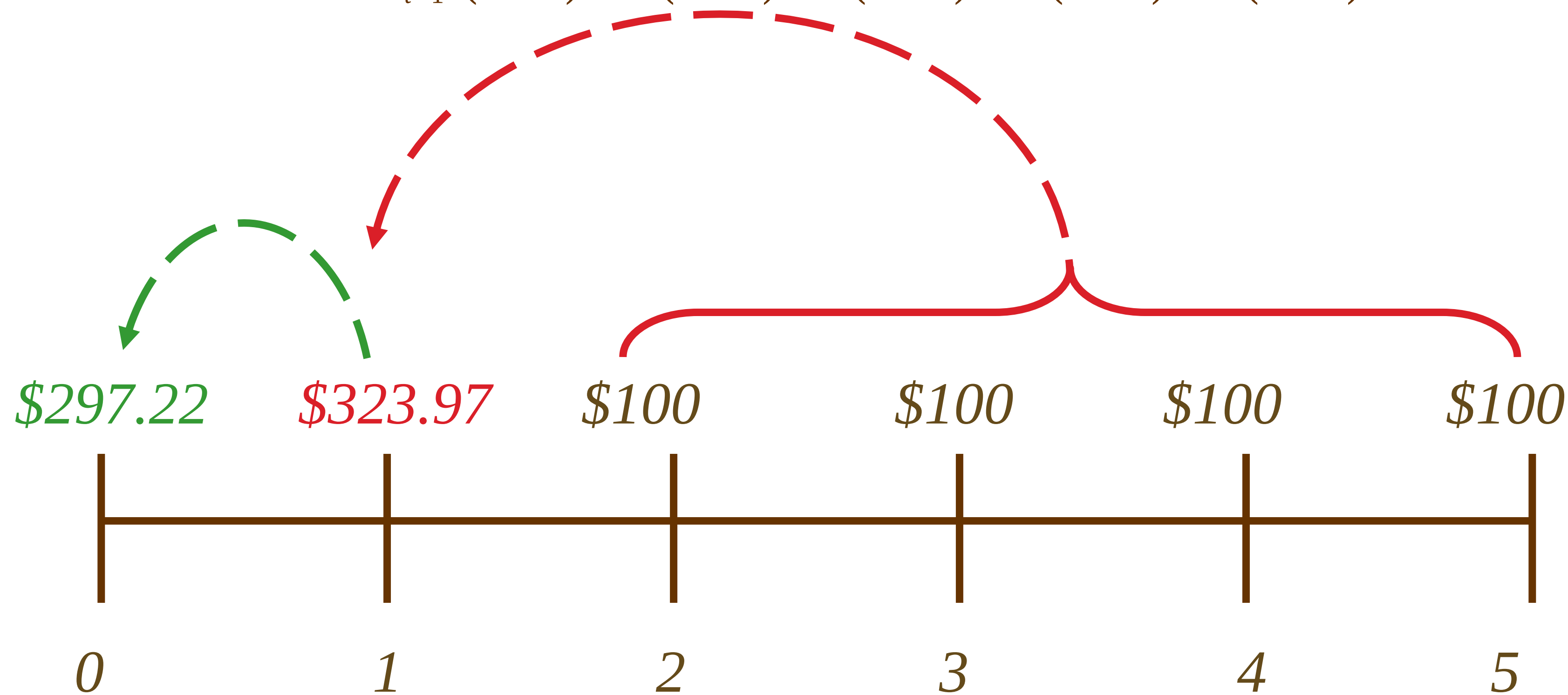
If you can afford a \$400 monthly car payment, how much car can you afford if interest rates are 7% on 36-month loans?



$$PV = \frac{\$400}{.07/12}\left[1 - \frac{1}{(1+.07/12)^{36}}\right] = \$12{,}954.59$$

What is the present value of a four-year annuity of \$100 per year that makes its first payment two years from today if the discount rate is 9%?

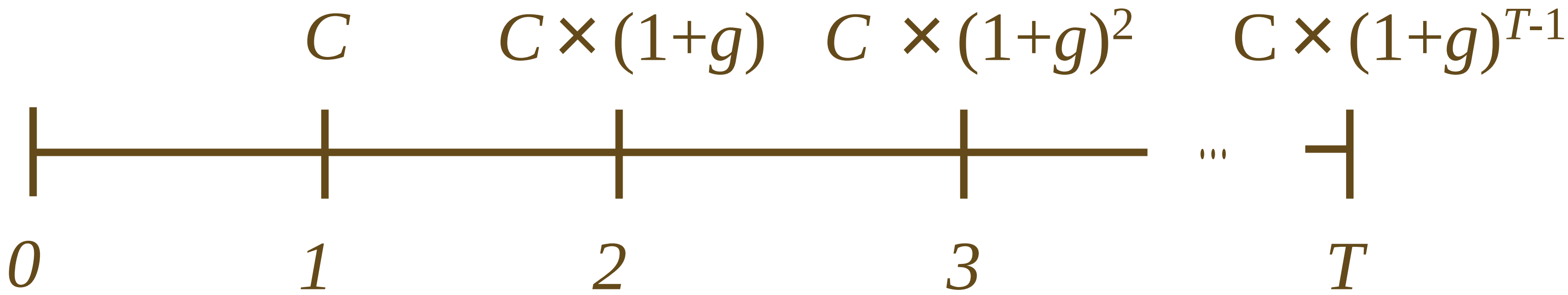
$$PV_1 = \sum_{t=1}^{4} \frac{\$100}{(1.09)^t} = \frac{\$100}{(1.09)^1} + \frac{\$100}{(1.09)^2} + \frac{\$100}{(1.09)^3} + \frac{\$100}{(1.09)^4} = \$323.97$$



$$PV_0 = \frac{\$327.97}{1.09} = \$297.22$$

Growing Annuity

A growing stream of cash flows with a fixed maturity



$$PV = \frac{C}{(1+r)} + \frac{C \times (1+g)}{(1+r)^2} + \cdots + \frac{C \times (1+g)^{T-1}}{(1+r)^T}$$

$$PV = \frac{C}{r-g}\left[1 - \left(\frac{1+g}{(1+r)}\right)^T\right]$$

Growing Annuity: Example

A defined-benefit retirement plan offers to pay \$20,000 per year for 40 years and increase the annual payment by 3% each year. What is the present value at retirement if the discount rate is 10%?

$\$20{,}000$ $\quad$ $\$20{,}000 \times (1.03)$ $\quad$ $\$20{,}000 \times (1.03)^{39}$

0 $\quad$ *1* $\quad$ *2* $\quad$ *40*

$$PV = \frac{\$20{,}000}{.10 - .03}\left[1 - \left(\frac{1.03}{1.10}\right)^{40}\right] = \$265{,}121.57$$

Growing Annuity: Example

You are evaluating an income generating property. Net rent is received at the end of each year. The first year's rent is expected to be $8,500, and rent is expected to increase 7% each year. What is the present value of the estimated income stream over the first 5 years if the discount rate is 12%?

$\$8,500 \times (1.07)^2 =$ $\$8,500 \times (1.07)^4 =$

$\$8,500 \times (1.07) =$ $\$8,500 \times (1.07)^3 =$

\$8,500 \$9,095 \$9,731.65 \$10,412.87 \$11,141.77

0 *1* *2* *3* *4* *5*

\$34,706.26

4.5 Loan Amortization

- Pure Discount Loans are the simplest form of loan. The borrower receives money today and repays a single lump sum (principal and interest) at a future time.
- Interest-Only Loans require an interest payment each period, with full principal due at maturity.
- Amortized Loans require repayment of principal over time, in addition to required interest.

Pure Discount Loans

- Treasury bills are excellent examples of pure discount loans. The principal amount is repaid at some future date, without any periodic interest payments.
- If a T-bill promises to repay $10,000 in 12 months and the market interest rate is 7 percent, how much will the bill sell for in the market?
  - PV = 10,000 / 1.07 = 9,345.79

Interest-Only Loan

- Consider a 5-year, interest-only loan with a 7% interest rate. The principal amount is $10,000. Interest is paid annually.
  - What would the stream of cash flows be?
    - Years 1 – 4: Interest payments of .07(10,000) = 700
    - Year 5: Interest + principal = 10,700
- This cash flow stream is similar to the cash flows on corporate bonds, and we will talk about them in greater detail later.

$$PV = \frac{\$700}{.07}\left[1-\left(\frac{1}{1.07}\right)^5\right]+\frac{\$10,000}{(1.07)^5}$$

Amortized Loan with Fixed Principal Payment

- Consider a $350,000, 15 year loan at 9 % interest. The loan agreement requires the firm to pay $23,333.33 in principal each year plus interest for that year.
- Click on the icon to see the amortization table

Microsoft Office Excel Worksheet

Amortized Loan with Fixed Payment

- Each payment covers the interest expense plus reduces principal
- Consider the same 15 year loan with annual payments. The interest rate is 9% ,and the principal amount is $350,000.
  - What is the annual payment?

- Click on the Excel icon to see the amortization table

Microsoft Office Excel Worksheet

4.6 What Is a Firm Worth?

- Conceptually, a firm should be worth the present value of the firm’s cash flows.
- The tricky part is determining the size, timing, and *risk* of those cash flows.

Net Present Value and Other Investment Rules

Why Use Net Present Value?

- Accepting positive NPV projects benefits shareholders.
  - ✓ NPV uses cash flows
  - ✓ NPV uses all the cash flows of the project
  - ✓ NPV discounts the cash flows properly

The Net Present Value (NPV) Rule

- Net Present Value (NPV) =
  Total PV of future CF's + Initial Investment
- Estimating NPV:
  1. Estimate future cash flows: how much? and when?
  2. Estimate discount rate
  3. Estimate initial costs
- Minimum Acceptance Criterion: Accept if NPV > 0
- Ranking Criterion: Choose the highest NPV

Calculating NPV with Spreadsheets

- Spreadsheets are an excellent way to compute NPVs, especially when you have to compute the cash flows as well.
- Using the NPV function:
  - The first component is the required return entered as a decimal.
  - The second component is the range of cash flows *beginning with year 1*.
  - Add the initial investment after computing the NPV.

5.2 The Payback Period Method

- How long does it take the project to "pay back" its initial investment?
- Payback Period = number of years to recover initial costs
- Minimum Acceptance Criterion:
  - Set by management
- Ranking Criterion:
  - Set by management

The Payback Period Method

- Disadvantages:
  - Ignores the time value of money
  - Ignores cash flows after the payback period
  - Biased against long-term projects
  - Requires an arbitrary acceptance criteria
  - A project accepted based on the payback criteria may not have a positive NPV
- Advantages:
  - Easy to understand
  - Biased toward liquidity

5.3 The Discounted Payback Period

- How long does it take the project to "pay back" its initial investment, taking the time value of money into account?
- Decision rule: Accept the project if it pays back on a discounted basis within the specified time.
- By the time you have discounted the cash flows, you might as well calculate the NPV.

5.4 The Internal Rate of Return

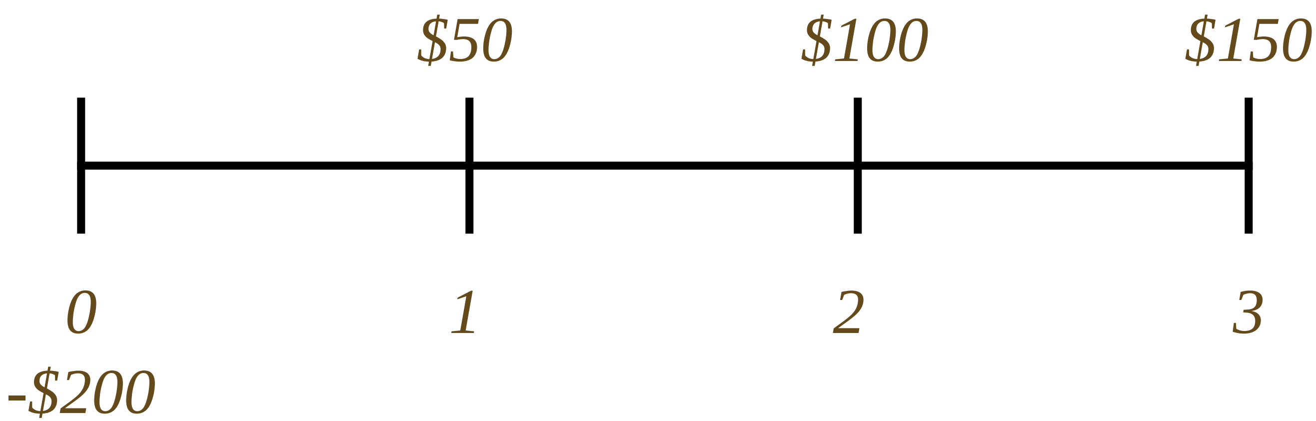
- IRR: the discount rate that sets NPV to zero
- Minimum Acceptance Criterion:
  - Accept if the IRR exceeds the required return
- Ranking Criterion:
  - Select alternative with the highest IRR
- Reinvestment assumption:
  - All future cash flows are assumed to be reinvested at the IRR

Internal Rate of Return (IRR)

- Disadvantages:
  - Does not distinguish between investing and borrowing
  - IRR may not exist, or there may be multiple IRRs
  - Problems with mutually exclusive investments
- Advantages:
  - Easy to understand and communicate

IRR: Example

Consider the following project:



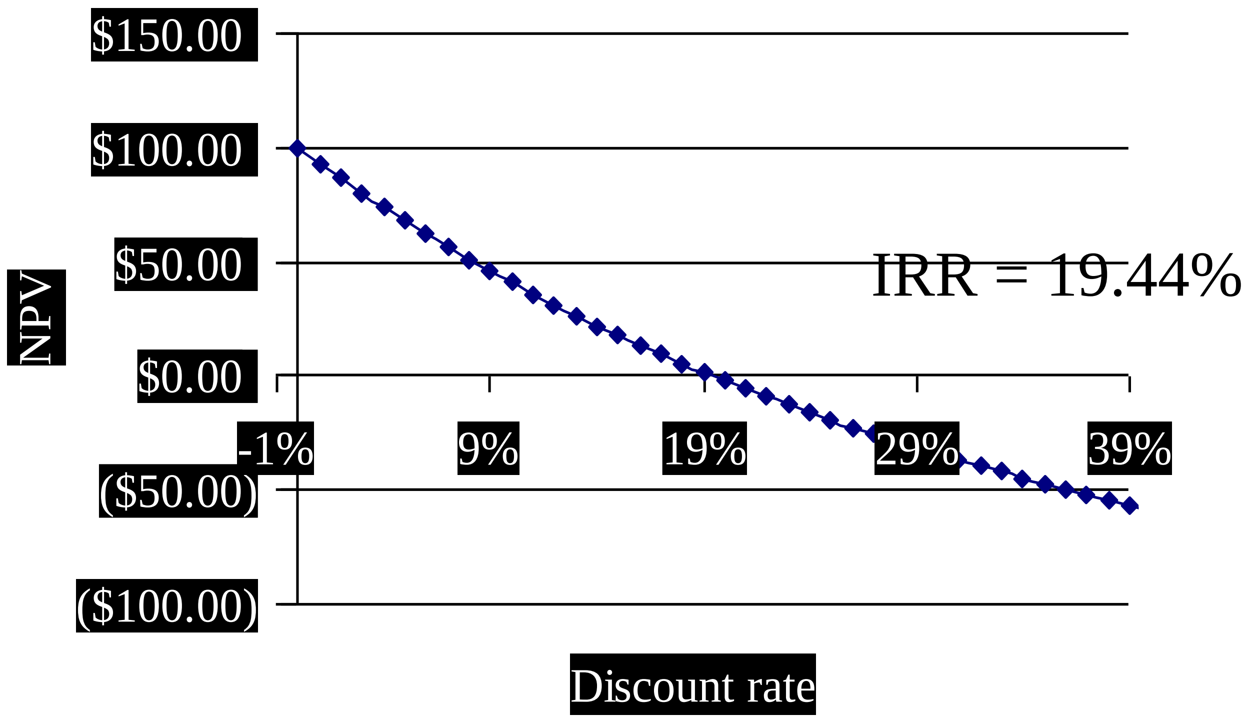
The internal rate of return for this project is 19.44%

$$NPV = 0 = -200 + \frac{\$50}{(1+IRR)} + \frac{\$100}{(1+IRR)^2} + \frac{\$150}{(1+IRR)^3}$$

NPV Payoff Profile

If we graph NPV versus the discount rate, we can see the IRR as the x-axis intercept.

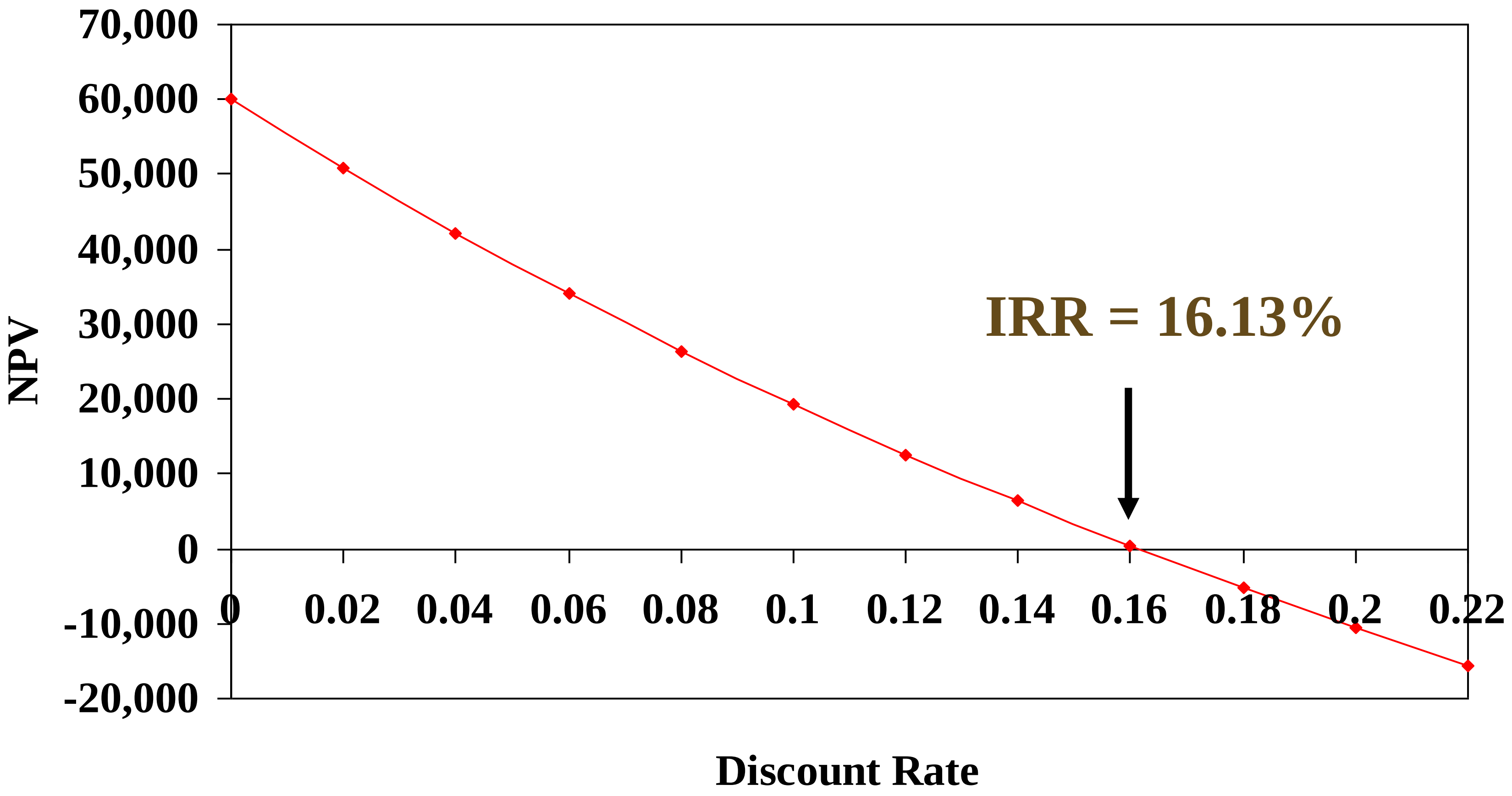
0%	$100.00
4%	$73.88
8%	$51.11
12%	$31.13
16%	$13.52
20%	($2.08)
24%	($15.97)
28%	($28.38)
32%	($39.51)
36%	($49.54)
40%	($58.60)
44%	($66.82)



Calculating IRR with Spreadsheets

- You start with the same cash flows as you did for the NPV.
- You use the IRR function:
  - You first enter your range of cash flows, beginning with the initial cash flow.
  - You can enter a guess, but it is not necessary.
  - The default format is a whole percent – you will normally want to increase the decimal places to at least two.

NPV Profile For The Project



5.5 Problems with IRR

- Multiple IRRs
- Are We Borrowing or Lending
- The Scale Problem
- The Timing Problem

Mutually Exclusive vs. Independent

- Mutually Exclusive Projects: only ONE of several potential projects can be chosen, e.g., acquiring an accounting system.
  - RANK all alternatives, and select the best one.

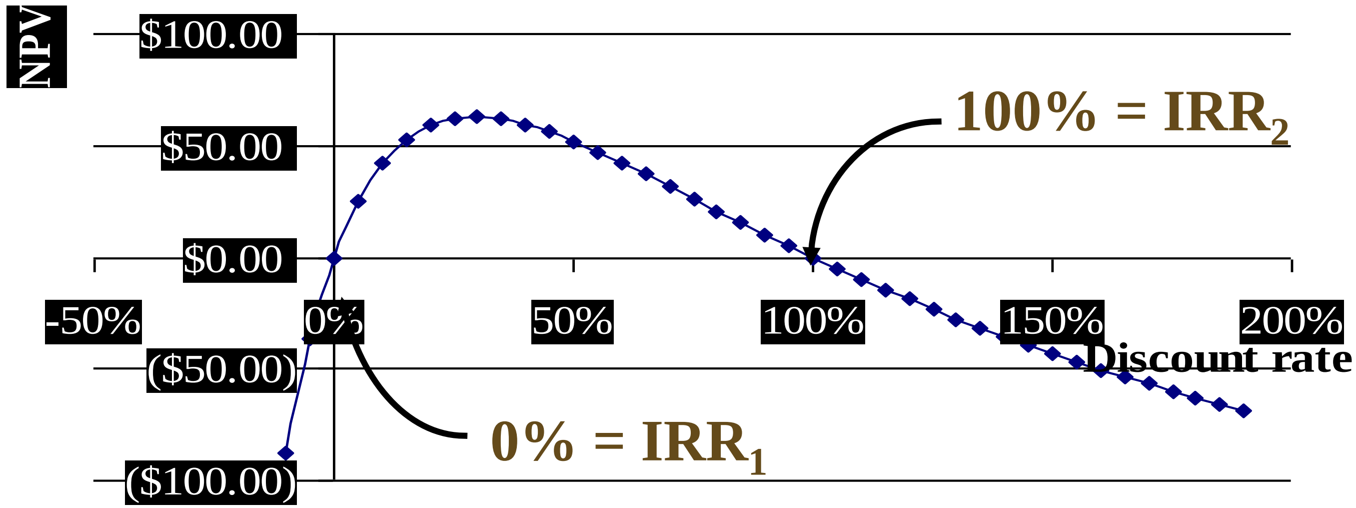
- Independent Projects: accepting or rejecting one project does not affect the decision of the other projects.
  - Must exceed a MINIMUM acceptance criterion

Multiple IRRs

There are two IRRs for this project:

0	1	2	3
-$200	$200	$800	- $800

Which one should we use?



Modified IRR

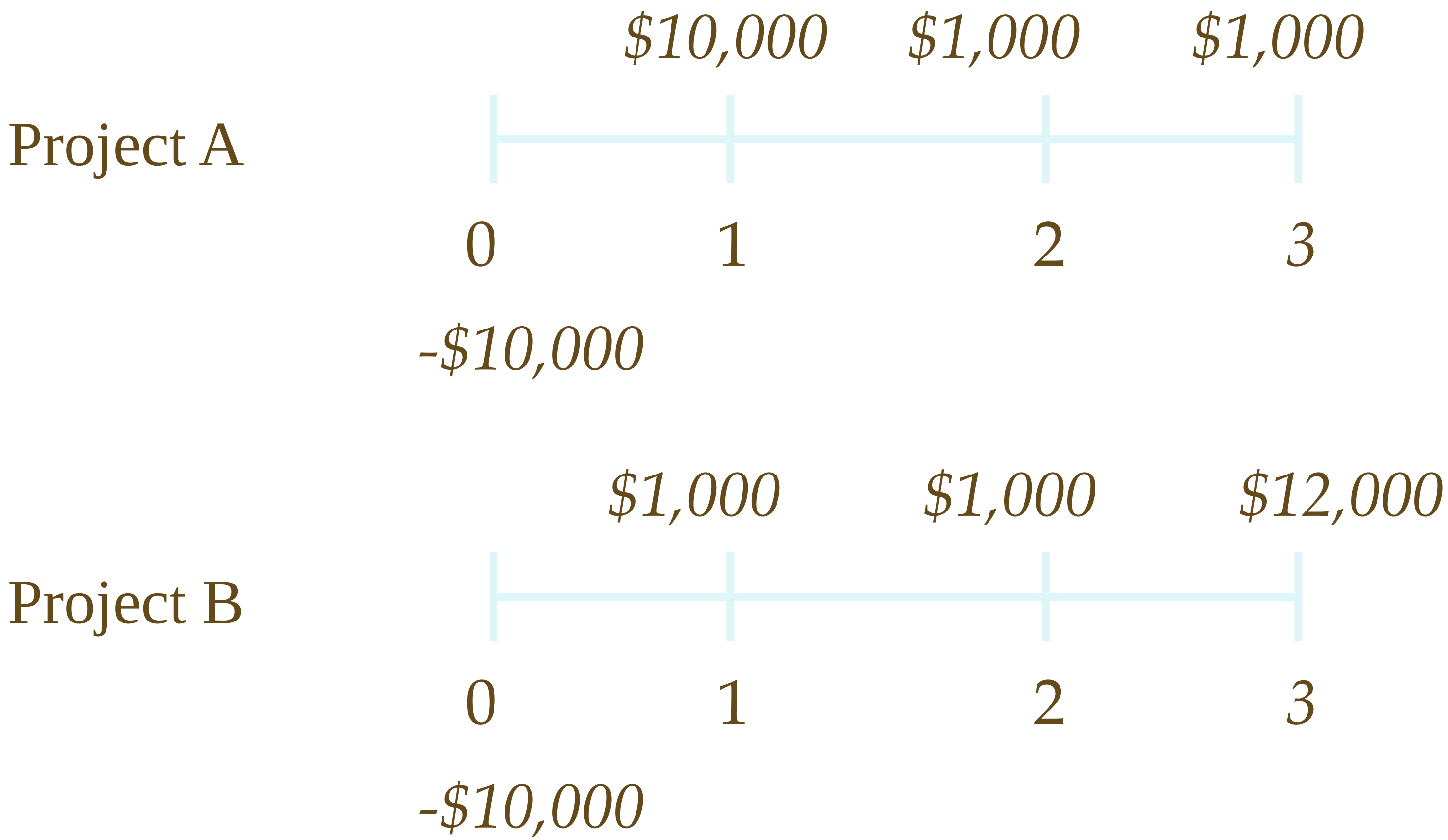
- Calculate the net present value of all cash outflows using the borrowing rate.
- Calculate the net future value of all cash inflows using the investing rate.
- Find the rate of return that equates these values.
- Benefits: single answer and specific rates for borrowing and reinvestment
- IRR assumes reinvestment at IRR
- NPV assumes reinvestment at the firm's weighted average cost of capital (opportunity cost of capital)

The Scale Problem

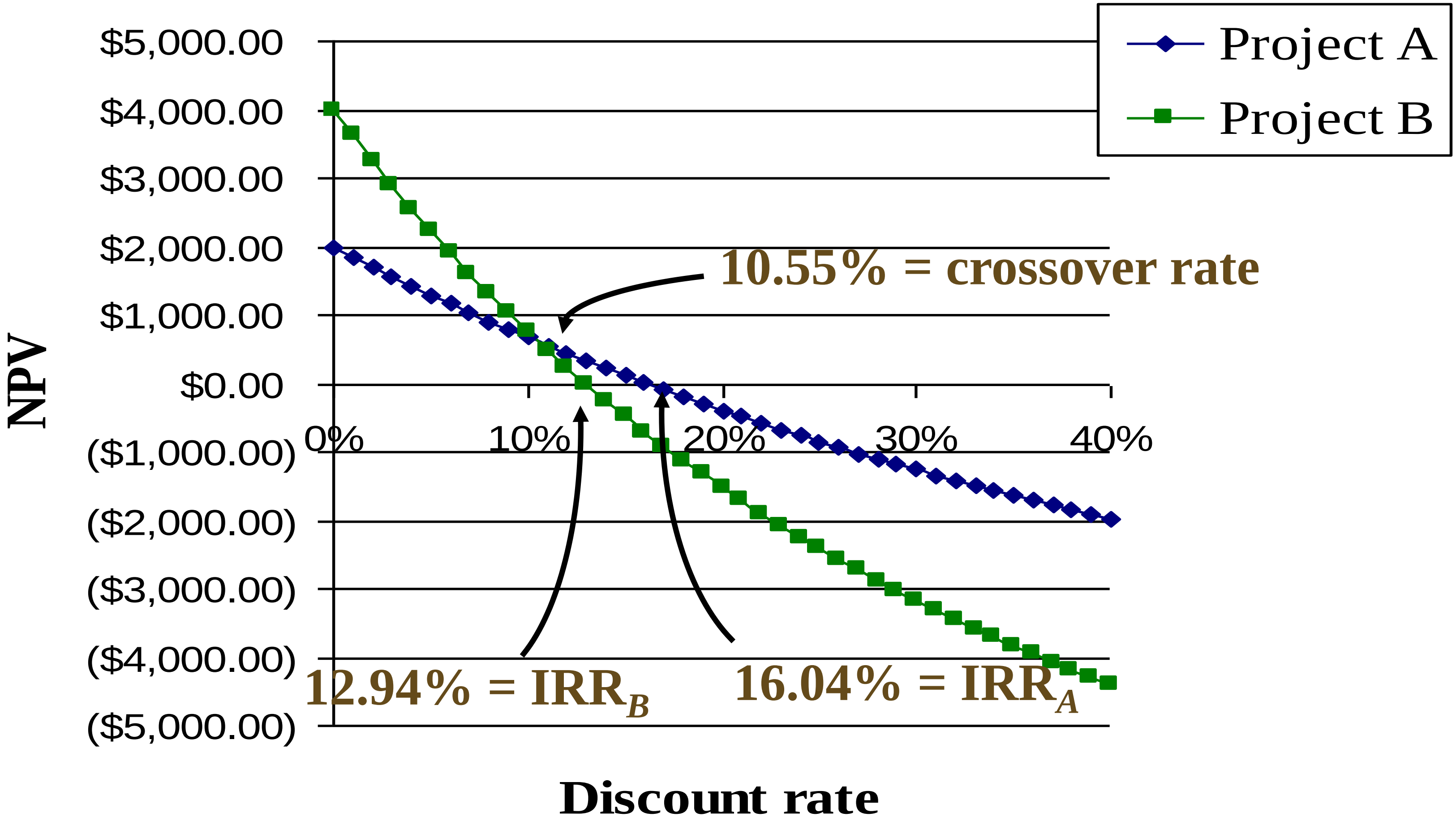
Would you rather make 100% or 50% on your investments?

What if the 100% return is on a $1 investment, while the 50% return is on a $1,000 investment?

The Timing Problem



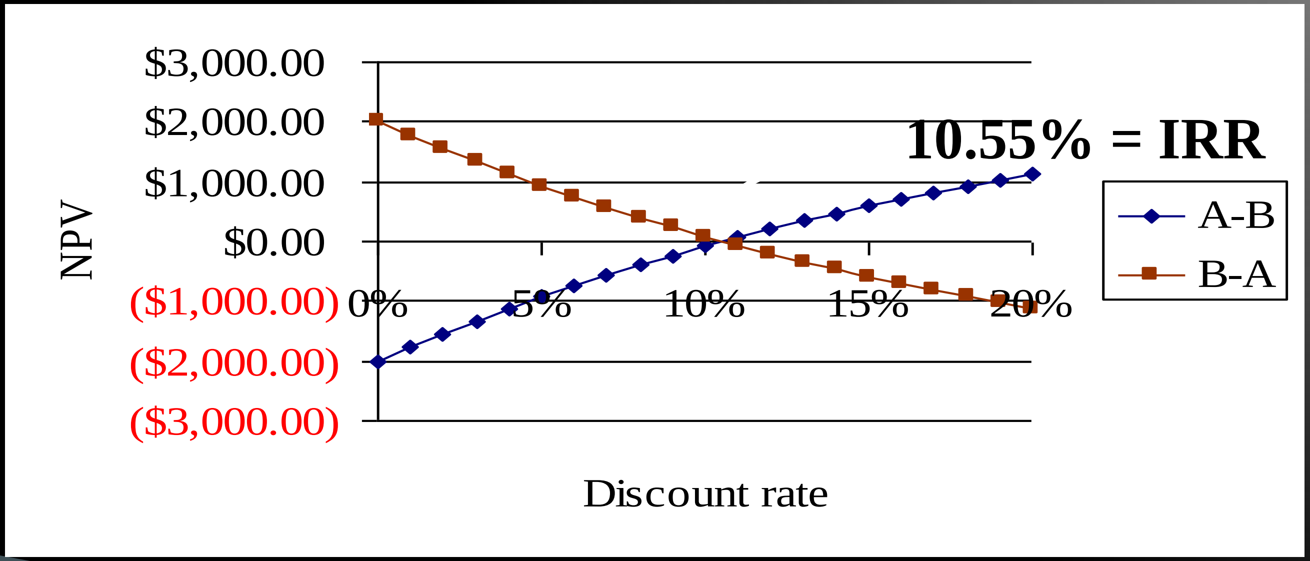
The Timing Problem



Calculating the Crossover Rate

he IRR for either project "A-B" or "B-A"

	($10,000)	($10,000)	$0	$0
11	$10,000	$1,000	$9,000	($9,000.00)
2	$1,000	$1,000	$0	$0
3	$1,000	$12,000	($11,000.00)	$11,000



Example: NPV versus IRR

- Project A has a higher IRR
- But if the discount rate (required return) for calculating NPV is less than 10.55%, then Project B has a higher NPV.
  - In such cases, IRR gives the wrong answer in selecting between projects
  - The difference in timing of cash flows underlies this problem

NPV versus IRR

- NPV and IRR will generally give the same decision.
- Exceptions:
  - Non-conventional cash flows – cash flow signs change more than once
  - Mutually exclusive projects
    - Initial investments are substantially different
    - Timing of cash flows is substantially different

5.6 The Profitability Index (PI)

$$PI = \frac{\text{Total PV of Future Cash Flows}}{\text{Initial Investent}}$$

- Minimum Acceptance Criterion:
  - Accept if PI > 1
- Ranking Criterion:
  - Select alternative with highest PI

The Profitability Index

- Disadvantages:
  - Problems with mutually exclusive investments

- Advantages:
  - May be useful when available investment funds are limited
  - Easy to understand and communicate
  - Correct decision when evaluating independent projects

5.7 The Practice of Capital Budgeting

- Varies by industry:
  - Some firms may use payback, while others choose an alternative approach.

- The most frequently used technique for large corporations is either IRR or NPV.

Example of Investment Rules

Compute the IRR, NPV, PI, and payback period for the following two projects. Assume the required return is 10%.

Year	Project A	Project B
0	–$200	–$150
1	$200	$50
2	$800	$100
3	–$800	$150

Example of Investment Rules

	Project A	Project B
CF_0	–\$200.00	–\$150.00
PV_0 of CF_{1-3}	\$241.92	\$240.80
NPV =	\$41.92	\$90.80
IRR =	0%, 100%	36.19%
PI =	1.2096	1.6053

Example of Investment Rules

Payback Period:

	Project A		Project B	
Time	CF	Cum. CF	CF	Cum.CF
0	–200	–200	–150	–150
1	200	0	50	–100
2	800	800	100	0
3	–800	0	150	150

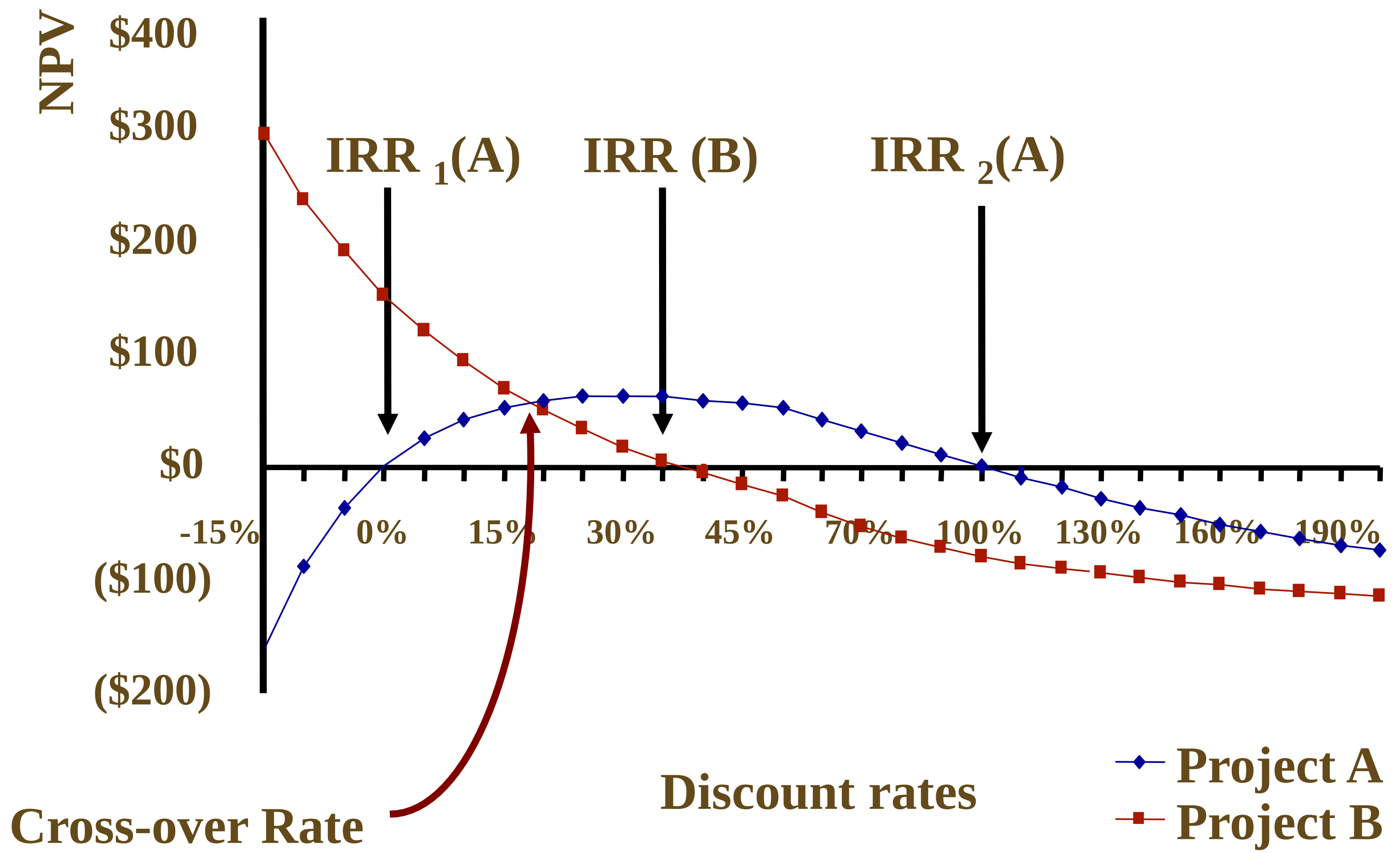
Payback period for project B = 2 years.

Payback period for project A = 1 or 3 years?

NPV and IRR Relationship

Discount rate	NPV for A	NPV for B
−10%	−87.52	234.77
0%	0.00	150.00
20%	59.26	47.92
40%	59.48	−8.60
60%	42.19	−43.07
80%	20.85	−65.64
100%	0.00	−81.25
120%	−18.93	−92.52

NPV Profiles



Summary – Discounted Cash Flow

- Net present value
  - Difference between market value and cost
  - Accept the project if the NPV is positive
  - Has no serious problems
  - Preferred decision criterion
- Internal rate of return
  - Discount rate that makes NPV = 0
  - Take the project if the IRR is greater than the required return
  - Same decision as NPV with conventional cash flows
  - IRR is unreliable with non-conventional cash flows or mutually exclusive projects
- Profitability Index
  - Benefit-cost ratio
  - Take investment if PI > 1
  - Cannot be used to rank mutually exclusive projects
  - May be used to rank projects in the presence of capital rationing

Summary – Payback Criterion

- Payback period
  - Length of time until initial investment is recovered
  - Take the project if it pays back in some specified period
  - Does not account for time value of money, and there is an arbitrary cutoff period
- Discounted payback period
  - Length of time until initial investment is recovered on a discounted basis
  - Take the project if it pays back in some specified period
  - There is an arbitrary cutoff period

Quick Quiz

- Consider an investment that costs $100,000 and has a cash inflow of $25,000 every year for 5 years. The required return is 9%, and payback cutoff is 4 years.
  - What is the payback period?
  - What is the discounted payback period?
  - What is the NPV?
  - What is the IRR?
  - Should we accept the project?
- What method should be the primary decision rule?
- When is the IRR rule unreliable?

Lecture 4

Making Capital Investment Decisions

Key Concepts and Skills

- Understand how to determine the relevant cash flows for various types of capital investments
- Be able to compute depreciation expense for tax purposes
- Understand the various methods for computing operating cash flow
- Evaluate special cases of discounted cash flow analysis
- Incorporate inflation into capital budgeting

Chapter Outline

6.1 Incremental Cash Flows

6.2 The Baldwin Company: An Example

6.3 Alternative Definitions of Operating Cash Flow

6.4 Some Special Cases of Discounted Cash Flow Analysis

6.5 Inflation and Capital Budgeting

6.1 Incremental Cash Flows

- Cash flows matter—not accounting earnings.
- Sunk costs do not matter.
- *Incremental* cash flows matter.
- Opportunity costs matter.
- Side effects like cannibalism and erosion matter.
- Taxes matter: we want incremental after-tax cash flows.
- Inflation matters.

Cash Flows—Not Accounting Income

- Consider depreciation expense.
  - You never write a check made out to "depreciation."
- Much of the work in evaluating a project lies in taking accounting numbers and generating cash flows.

Incremental Cash Flows

- Sunk costs are not relevant
  - Just because "we have come this far" does not mean that we should continue to throw good money after bad.
- Opportunity costs *do* matter. Just because a project has a positive NPV, that does not mean that it should also have automatic acceptance. Specifically, if another project with a higher NPV would have to be passed up, then we should not proceed.

Incremental Cash Flows

- Side effects matter.
  - Erosion is a “bad” thing. If our new product causes existing customers to demand less of our current products, we need to recognize that.
  - If, however, synergies result that create increased demand of existing products, we also need to recognize that.

Estimating Cash Flows

- Cash Flow from Operations
  - Recall that:

    OCF = EBIT – Taxes + Depreciation
- Net Capital Spending
  - Do not forget salvage value (after tax, of course).
- Changes in Net Working Capital
  - Recall that when the project winds down, we enjoy a return of net working capital.

Interest Expense

- Later chapters will deal with the impact that the amount of debt that a firm has in its capital structure has on firm value.
- For now, it is enough to assume that the firm's level of debt (and, hence, interest expense) is independent of the project at hand.

6.2 The Baldwin Company

- Costs of test marketing (already spent): $250,000
- Current market value of proposed factory site (which we own): $150,000
- Cost of bowling ball machine: $100,000 (depreciated according to MACRS 5-year)
- Increase in net working capital: $10,000
- Production (in units) by year during 5-year life of the machine: 5,000, 8,000, 12,000, 10,000, 6,000

6.2 The Baldwin Company

- Pre-tax salvage value of machine $30,000
- Tax on sale at 34% of excess over depreciated basis
- 0.34*(30,000 – 5,800) = $8,228
- After-tax salvage value = $21,772

The Baldwin Company

- Price during first year is $20; price increases 2% per year thereafter.
- Production costs during first year are $10 per unit and increase 10% per year thereafter.
- Annual inflation rate: 5%
- Working Capital: initial $10,000 changes with sales

The Baldwin Company

($ thousands) (All cash flows occur at the *end* of the year.)

	Year 0	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*
Investments:						
(1) Bowling ball machine	–100.00					21.76*
(2) Accumulated depreciation		20.00	52.00	71.20	82.72	94.24
(3) Adjusted basis of machine after depreciation (end of year)		80.00	48.00	28.80	17.28	5.76
(4) Opportunity cost (warehouse)	–150.00					150.00
(5) Net working capital (end of year)	10.00	10.00	16.32	24.97	21.22	0
(6) Change in net working capital	–10.00		–6.32	–8.65	3.75	21.22
(7) Total cash flow of investment [(1) + (4) + (6)]	–260.00		–6.32	–8.65	3.75	192.98

The Baldwin Company

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Investments:						
(1) Bowling ball machine	–100.00					21.76
(2) Accumulated depreciation		20.00	52.00	71.20	82.72	94.24
(3) Adjusted basis of machine after depreciation (end of year)		80.00	48.00	28.80	17.28	5.76
(4) Opportunity cost (warehouse)	–150.00					150.00
(5) Net working capital (end of year)	10.00	10.00	16.32	24.97	21.22	0
(6) Change in net working capital	–10.00		–6.32	–8.65	3.75	21.22
(7) Total cash flow of investment [(1) + (4) + (6)]	–260.00		–6.32	–8.65	3.75	192.98

At the end of the project, the warehouse is unencumbered, so we can sell it if we want to.

The Baldwin Company

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Income:						
(8) Sales Revenues		100.00	163.20	249.70	212.24	129.89

Recall that production (in units) by year during the 5-year life of the machine is given by:

(5,000, 8,000, 12,000, 10,000, 6,000).

Price during the first year is $20 and increases 2% per year thereafter.

Sales revenue in year 2 = 8,000 × [$20 × $(1.02)^1$] = 8,000 × $20.40 = $163,200.

The Baldwin Company

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Income:						
(8) Sales Revenues		100.00	163.20	249.70	212.24	129.89
(9) Operating costs		50.00	88.00	145.20	133.10	87.85

Again, production (in units) by year during 5-year life of the machine is given by:

(5,000, 8,000, 12,000, 10,000, 6,000).

Production costs during the first year (per unit) are \$10, and they increase 10% per year thereafter.

Production costs in year 2 = 8,000 × [\$10 × $(1.10)^1$] = \$88,000

The Baldwin Company

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Income:						
(8) Sales Revenues		100.00	163.20	249.70	212.24	129.89
(9) Operating costs		-50.00	-88.00	-145.20	-133.10	-87.85
(10) Depreciation		-20.00	-32.00	-19.20	-11.52	-11.52

Depreciation is calculated using the Modified Accelerated Cost Recovery System (shown at right).

Our cost basis is $100,000.

Depreciation charge in year 4

= $100,000 × (.1152) = $11,520.

Year	ACRS %
1	20.00%
2	32.00%
3	19.20%
4	11.52%
5	11.52%
6	5.76%
Total	100.00%

The Baldwin Company

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Income:						
(8) Sales Revenues		100.00	163.20	249.70	212.24	129.89
(9) Operating costs		-50.00	-88.00	-145.20	-133.10	-87.85
(10) Depreciation		-20.00	-32.00	-19.20	-11.52	-11.52
(11) Income before taxes [(8) – (9) - (10)]		30.00	43.20	85.30	67.62	30.53
(12) Tax at 34 percent		-10.20	-14.69	-29.00	-22.99	-10.38
(13) Net Income		19.80	28.51	56.30	44.63	20.15

Incremental After Tax Cash Flows

	Year 0	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*
(1) Sales Revenues		\$100.00	\$163.20	\$249.70	\$212.24	\$129.89
(2) Operating costs		-50.00	-88.00	-145.20	-133.10	-87.85
(3) Taxes		-10.20	-14.69	-29.00	-22.99	-10.38
(4) OCF (1) – (2) – (3)		39.80	60.51	75.50	56.15	31.67
(5) Total CF of Investment	–260		–6.32	–8.65	3.75	192.98
(6) IATCF [(4) + (5)]	–260	39.80	54.19	66.85	59.90	224.65

$$NPV = -\$260 + \frac{\$39.80}{(1.10)} + \frac{\$54.19}{(1.10)^2} + \frac{\$66.85}{(1.10)^3} + \frac{\$59.90}{(1.10)^4} + \frac{\$224.65}{(1.10)^5}$$

$$NPV = \$51.59$$

6.3 Alternative Definitions of OCF

- Top-Down Approach
  - OCF = Sales – Costs – Taxes
  - Do not subtract non-cash deductions
- Bottom-Up Approach
  - Works only when there is no interest expense
  - OCF = NI + depreciation
- Tax Shield Approach
  - OCF = (Sales – Costs)(1 – T) + Depreciation*T

6.4 Some Special Cases of Discounted Cash Flow Analysis

- Cost-Cutting Proposals
- Setting the Bid Price
- Investments of Unequal Lives

Cost-Cutting Proposals

- Cost savings will increase pretax income
  - But, we have to pay taxes on this amount
- Depreciation will reduce our tax liability
- Does the present value of the cash flow associated with the cost savings exceed the cost?
  - If yes, then proceed.

Setting the Bid Price

- Find the sales price that makes NPV = 0
  - Step 1: Use known changes in NWC and capital to estimate "preliminary" NPV
  - Step 2: Determine what yearly OCF is needed to make NPV = 0
  - Step 3: Determine what NI is required to generate the OCF
    - OCF = NI + Depreciation
  - Step 4: Identify what sales (and price) are necessary to create the required NI
    - NI = (Sales – Costs – Depreciation)*(1 – T)

Investments of Unequal Lives

- There are times when application of the NPV rule can lead to the wrong decision. Consider a factory that must have an air cleaner that is mandated by law. There are two choices:
  - The “Cadillac cleaner” costs $4,000 today, has annual operating costs of $100, and lasts 10 years.
  - The “Cheapskate cleaner” costs $1,000 today, has annual operating costs of $500, and lasts 5 years.
- Assuming a 10% discount rate, which one should we choose?
- NPV of Cadillac is -4,614.46
- NPV of Cheapskate is -2895.39

-Higher but lasts only 5 years

Investments of Unequal Lives

- This overlooks the fact that the Cadillac cleaner lasts twice as long.
- When we incorporate the difference in lives, the Cadillac cleaner is actually cheaper (i.e., has a higher NPV).

Equivalent Annual Cost (EAC)

- The EAC is the value of the level payment annuity that has the same *PV* as our original set of cash flows.
  - For example, the EAC for the Cadillac air cleaner is $750.98.
  - The EAC for the Cheapskate air cleaner is $763.80, thus we should reject it.

6.5 Inflation and Capital Budgeting

- Inflation is an important fact of economic life and must be considered in capital budgeting.
- Consider the relationship between interest rates and inflation, often referred to as the Fisher equation:

  (1 + Nominal Rate) = (1 + Real Rate) × (1 + Inflation Rate)

Inflation and Capital Budgeting

- For low rates of inflation, this is often approximated:

$$\text{Real Rate} \cong \text{Nominal Rate} - \text{Inflation Rate}$$

- While the nominal rate in the U.S. has fluctuated with inflation, the real rate has generally exhibited far less variance than the nominal rate.
- In capital budgeting, one must compare real cash flows discounted at real rates or nominal cash flows discounted at nominal rates.

Quick Quiz

- How do we determine if cash flows are relevant to the capital budgeting decision?
- What are the different methods for computing operating cash flow, and when are they important?
- What is equivalent annual cost, and when should it be used?
- How should cash flows and discount rates be matched when inflation is present?

Lecture 5

Risk Analysis, Real Options, and Capital Budgeting

Key Concepts and Skills

- Understand and be able to apply scenario and sensitivity analysis
- Understand the various forms of break-even analysis
- Understand Monte Carlo simulation
- Understand the importance of real options in capital budgeting
- Understand decision trees

7.1 Sensitivity, Scenario, and Break-Even

- Each allows us to look behind the NPV number to see how stable our estimates are.
- When working with spreadsheets, try to build your model so that you can adjust variables in a single cell and have the NPV calculations update accordingly.

Example: Stewart Pharmaceuticals

- Stewart Pharmaceuticals Corporation is considering investing in the development of a drug that cures the common cold.
- A corporate planning group, including representatives from production, marketing, and engineering, has recommended that the firm go ahead with the test and development phase.
- This preliminary phase will last one year and cost $1 billion. Furthermore, the group believes that there is a 60% chance that tests will prove successful.
- If the initial tests are *successful*, Stewart Pharmaceuticals can go ahead with full-scale production. This investment phase will cost $1.6 billion. Production will occur over the following 4 years.

NPV Following Successful Test

Investment	Year 1	Years 2-5
Revenues		$7,000
Variable Costs		(3,000)
Fixed Costs		(1,800)
Depreciation		(400)
Pretax profit		$1,800
Tax (34%)		(612)
Net Profit		$1,188
Cash Flow	-$1,600	$1,588

Note that the *NPV* is calculated as of date 1, the date at which the investment of $1,600 million is made. Later we bring this number back to date 0. Assume a cost of capital of 10%.

$$NPV_1 = -\$1,600 + \sum_{t=1}^{4} \frac{\$1,588}{(1.10)^t}$$

$$NPV_1 = \$3,433.75$$

NPV Following Unsuccessful Test

Investment	Year 1	Years 2-5
Revenues		$4,050
Variable Costs		(1,735)
Fixed Costs		(1,800)
Depreciation		(400)
Pretax profit		$115
Tax (34%)		(39.10)
Net Profit		$75.90
Cash Flow	-$1,600	$475.90

Note that the *NPV* is calculated as of date 1, the date at which the investment of $1,600 million is made. Later we bring this number back to date 0. Assume a cost of capital of 10%.

$$NPV_1 = -\$1{,}600 + \sum_{t=1}^{4} \frac{\$475.90}{(1.10)^t}$$

$$NPV_1 = -\$91.461$$

Decision to Test

- Let's move back to the first stage, where the decision boils down to the simple question: should we invest?
- The expected payoff evaluated at date 1 is:

$$\begin{matrix}\text{Expected}\\\text{payoff}\end{matrix} = \left(\begin{matrix}\text{Prob.}\\\text{sucess}\end{matrix} \times \begin{matrix}\text{Payoff}\\\text{given success}\end{matrix}\right) + \left(\begin{matrix}\text{Prob.}\\\text{failure}\end{matrix} \times \begin{matrix}\text{Payoff}\\\text{given failure}\end{matrix}\right)$$

$$\begin{matrix}\text{Expected}\\\text{payoff}\end{matrix} = (.60 \times \$3,433.75) + (.40 \times \$0) = \$2,060.25$$

The NPV evaluated at date 0 is:

$$NPV = -\$1,000 + \frac{\$2,060.25}{1.10} = \$872.95$$

So, we should test.

Sensitivity Analysis: Stewart

- We can see that NPV is very sensitive to changes in revenues. In the Stewart Pharmaceuticals example, a 14% drop in revenue leads to a 61% drop in NPV.

$$\%\Delta \text{Rev} = \frac{\$6{,}000 - \$7{,}000}{\$7{,}000} = -14.29\%$$

$$\%\Delta NPV = \frac{\$1{,}341.64 - \$3{,}433.75}{\$3{,}433.75} = -60.93\%$$

For every 1% drop in revenue, we can expect roughly a 4.26% drop in NPV:

$$-4.26 = \frac{-60.93\%}{14.29\%}$$

Scenario Analysis: Stewart

- A variation on sensitivity analysis is scenario analysis.
- For example, the following three scenarios could apply to Stewart Pharmaceuticals:
  1. The next few years each have heavy cold seasons, and sales exceed expectations, but labor costs skyrocket.
  2. The next few years are normal, and sales meet expectations.
  3. The next few years each have lighter than normal cold seasons, so sales fail to meet expectations.
- Other scenarios could apply to FDA approval.
- For each scenario, calculate the NPV.

Break-Even Analysis

- Common tool for analyzing the relationship between sales volume and profitability
- There are three common break-even measures
  - Accounting break-even: sales volume at which net income = 0
  - Cash break-even: sales volume at which operating cash flow = 0
  - Financial break-even: sales volume at which net present value = 0

Break-Even Analysis: Stewart

- Another way to examine variability in our forecasts is break-even analysis.
- In the Stewart Pharmaceuticals example, we could be concerned with break-even revenue, break-even sales volume, or break-even price.
- To find either, we start with the break-even operating cash flow.

Break-Even Analysis: Stewart

- The project requires an investment of $1,600.
- In order to cover our cost of capital (break even), the project needs to generate a cash flow of $504.75 each year for four years.
- This is the project's break-even operating cash flow, OCF_{BE}.

N	4
I/Y	10
PV	1,600
PMT	– 504.75
FV	0

Break-Even Revenue: Stewart

Work backwards from OCF_{BE} to Break-Even Revenue

Revenue			$5,358.71
Variable cost		+ *VC*	$3,000
Fixed cost			$1,800
Depreciation		+*D*	<u>$400</u>
EBIT		+*FC*	$158.71
Tax (34%)	$\frac{\$104.75}{0.66}$		<u>$53.96</u>
Net Income			$104.75
	OCF = $104.75 + $400		$504.75

Break-Even Analysis: P_{BE}

- Now that we have break-even revenue of \$5,358.71 million, we can calculate break-even price.
- The original plan was to generate revenues of \$7 billion by selling the cold cure at \$10 per dose and selling 700 million doses per year,
- We can reach break-even revenue with a price of only:

$$\$5{,}358.71 \text{ million} = 700 \text{ million} \times P_{BE}$$

$$P_{BE} = \frac{\$5{,}358.71}{700} = \$7.66 \text{ / dose}$$

7.2 Monte Carlo Simulation

- Monte Carlo simulation is a further attempt to model real-world uncertainty.
- This approach takes its name from the famous European casino, because it analyzes projects the way one might evaluate gambling strategies.

Monte Carlo Simulation

- Imagine a serious blackjack player who wants to know if she should take the third card whenever her first two cards total sixteen.
  - She could play thousands of hands for real money to find out.
  - This could be hazardous to her wealth.
  - Or, she could play thousands of practice hands.
- Monte Carlo simulation of capital budgeting projects is in this spirit.

Monte Carlo Simulation

- Monte Carlo simulation of capital budgeting projects is often viewed as a step beyond either sensitivity analysis or scenario analysis.
- Interactions between the variables are explicitly specified in Monte Carlo simulation; so, at least theoretically, this methodology provides a more complete analysis.
- While the pharmaceutical industry has pioneered applications of this methodology, its use in other industries is far from widespread.

Monte Carlo Simulation

- Step 1: Specify the Basic Model
- Step 2: Specify a Distribution for Each Variable in the Model
- Step 3: The Computer Draws One Outcome
- Step 4: Repeat the Procedure
- Step 5: Calculate NPV

7.3 Real Options

- One of the fundamental insights of modern finance theory is that options have value.
- The phrase “We are out of options” is surely a sign of trouble.
- Because corporations make decisions in a dynamic environment, they have options that should be considered in project valuation.

Real Options

- The Option to Expand
  - Has value if demand turns out to be higher than expected
- The Option to Abandon
  - Has value if demand turns out to be lower than expected
- The Option to Delay
  - Has value if the underlying variables are changing with a favorable trend

Discounted CF and Options

- We can calculate the market value of a project as the sum of the NPV of the project without options and the value of the managerial options implicit in the project.

$$M = NPV + Opt$$

A good example would be comparing the desirability of a specialized machine versus a more versatile machine. If they both cost about the same and last the same amount of time, the more versatile machine is more valuable because it comes with options.

The Option to Abandon: Example

- Suppose we are drilling an oil well. The drilling rig costs $300 today, and in one year the well is either a success or a failure.
- The outcomes are equally likely. The discount rate is 10%.
- The *PV* of the successful payoff at time one is $575.
- The *PV* of the unsuccessful payoff at time one is $0.

The Option to Abandon: Example

Traditional NPV analysis would indicate rejection of the project.

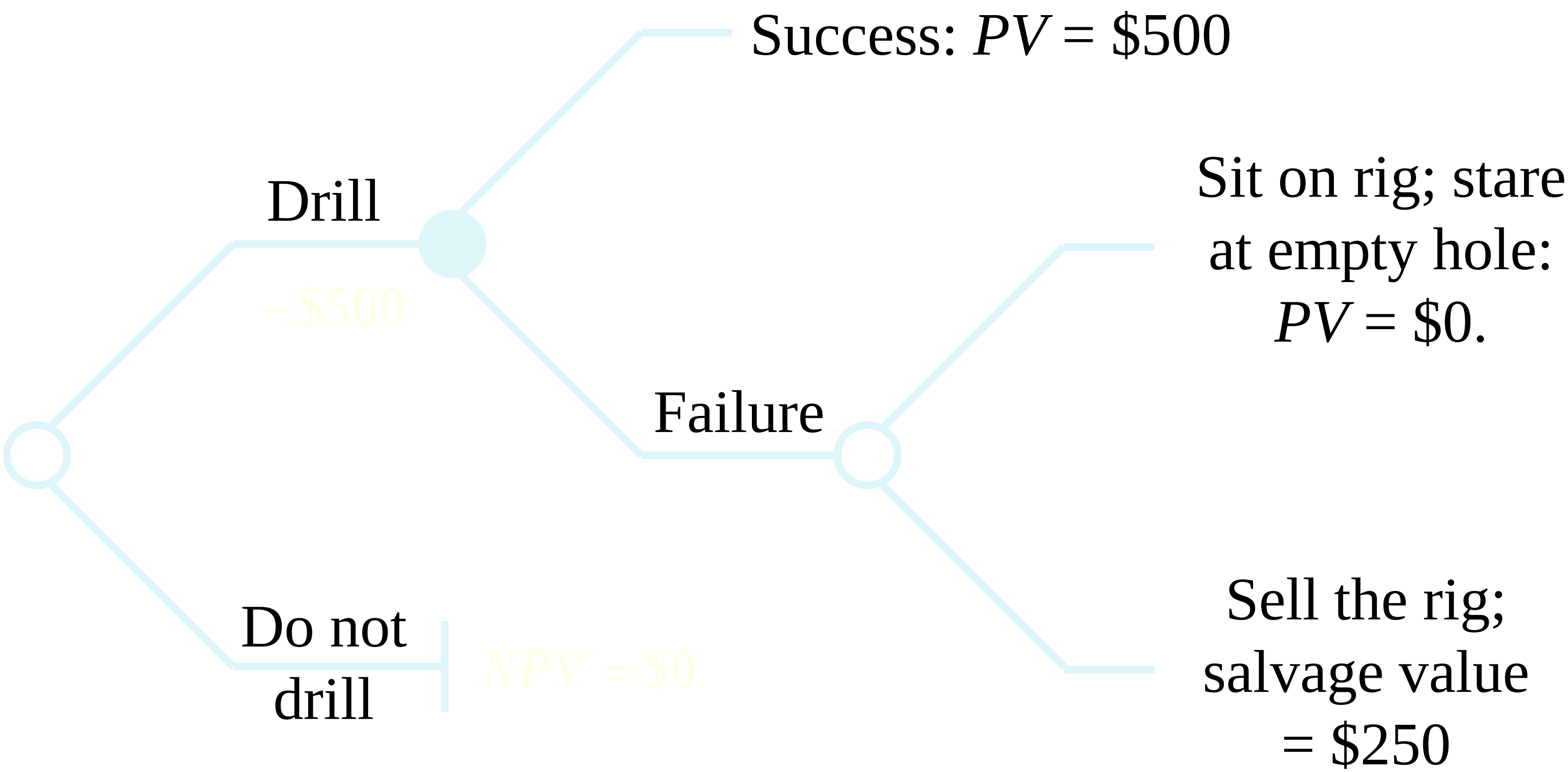
$$\text{Expected Payoff} = \text{Prob. Success} \times \text{Successful Payoff} + \text{Prob. Failure} \times \text{Failure Payoff}$$

$$\text{Expected Payoff} = (0.50 \times \$575) + (0.50 \times \$0) = \$287.50$$

$$NPV = -\$300 + \frac{\$287.50}{1.10} = -\$38.64$$

The Option to Abandon: Example

However, traditional NPV analysis overlooks the option to abandon.



The firm has two decisions to make: drill or not, abandon or stay.

The Option to Abandon: Example

- When we include the value of the option to abandon, the drilling project should proceed:

$$\text{Expected Payoff} = \text{Prob. Success} \times \text{Successful Payoff} + \text{Prob. Failure} \times \text{Failure Payoff}$$

$$\text{Expected Payoff} = (0.50 \times \$575) + (0.50 \times \$250) = \$412.50$$

$$NPV = -\$300 + \frac{\$412.50}{1.10} = \$75.00$$

Valuing the Option to Abandon

- Recall that we can calculate the market value of a project as the sum of the NPV of the project without options and the value of the managerial options implicit in the project.

$$M = NPV + Opt$$

$$\$75.00 = –\$38.64 + Opt$$

$$\$75.00 + \$38.64 = Opt$$

$$Opt = \$113.64$$

The Option to Delay: Example

Year	*Cost*	*PV*	*NPV $_t$*	*NPV $_0$*
0	\$ 20,000	\$ 25,000	\$5,000	\$5,000
1	\$ 18,000	\$ 25,000	\$7,000	\$6,364
2	\$ 17,100	\$ 25,000	\$7,900	\$6,529
3	\$ 16,929	\$ 25,000	\$8,071	\$6,064
4	\$ 16,760	\$ 25,000	\$8,240	\$5,628

$$\$6{,}529 = \frac{\$7{,}900}{(1.10)^2}$$

- Consider the above project, which can be undertaken in any of the next 4 years. The discount rate is 10 percent. The present value of the benefits at the time the project is launched remains constant at $25,000, but since costs are declining, the NPV at the time of launch steadily rises.
- The best time to launch the project is in year 2—this schedule yields the highest NPV when judged today.

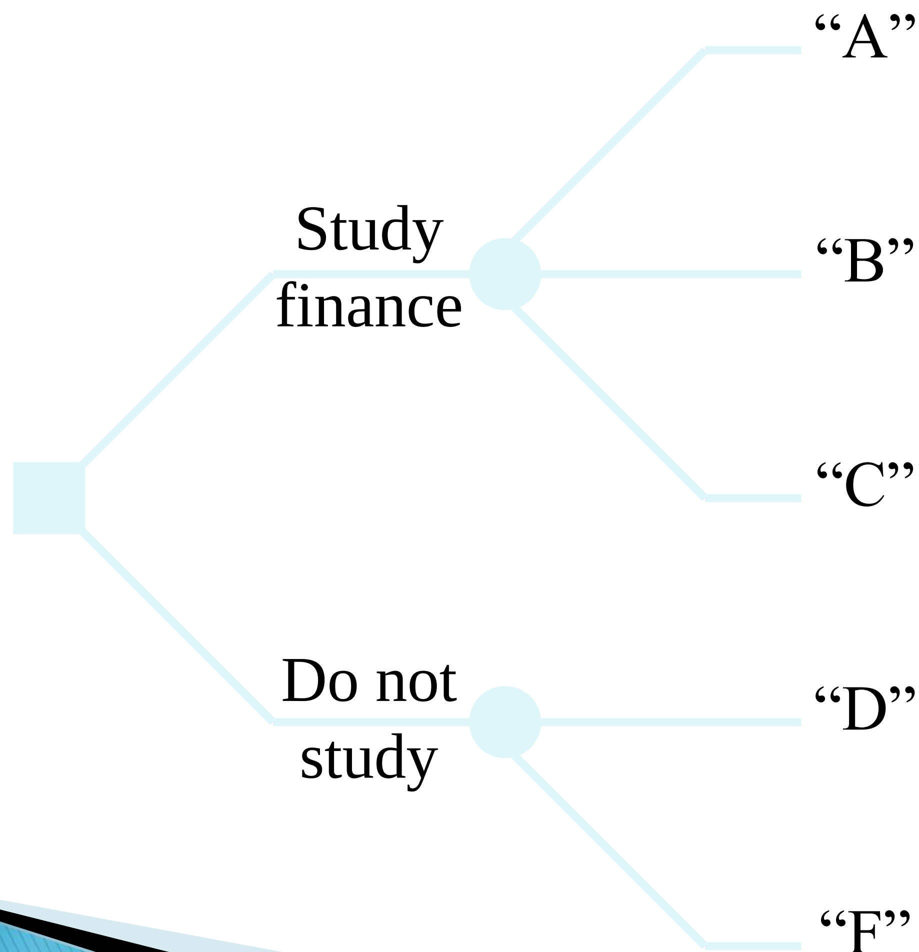
7.4 Decision Trees

- Allow us to graphically represent the alternatives available to us in each period and the likely consequences of our actions
- This graphical representation helps to identify the best course of action.

Example of a Decision Tree

Squares represent decisions to be made.

Circles represent receipt of information, *e.g.*, a test score.



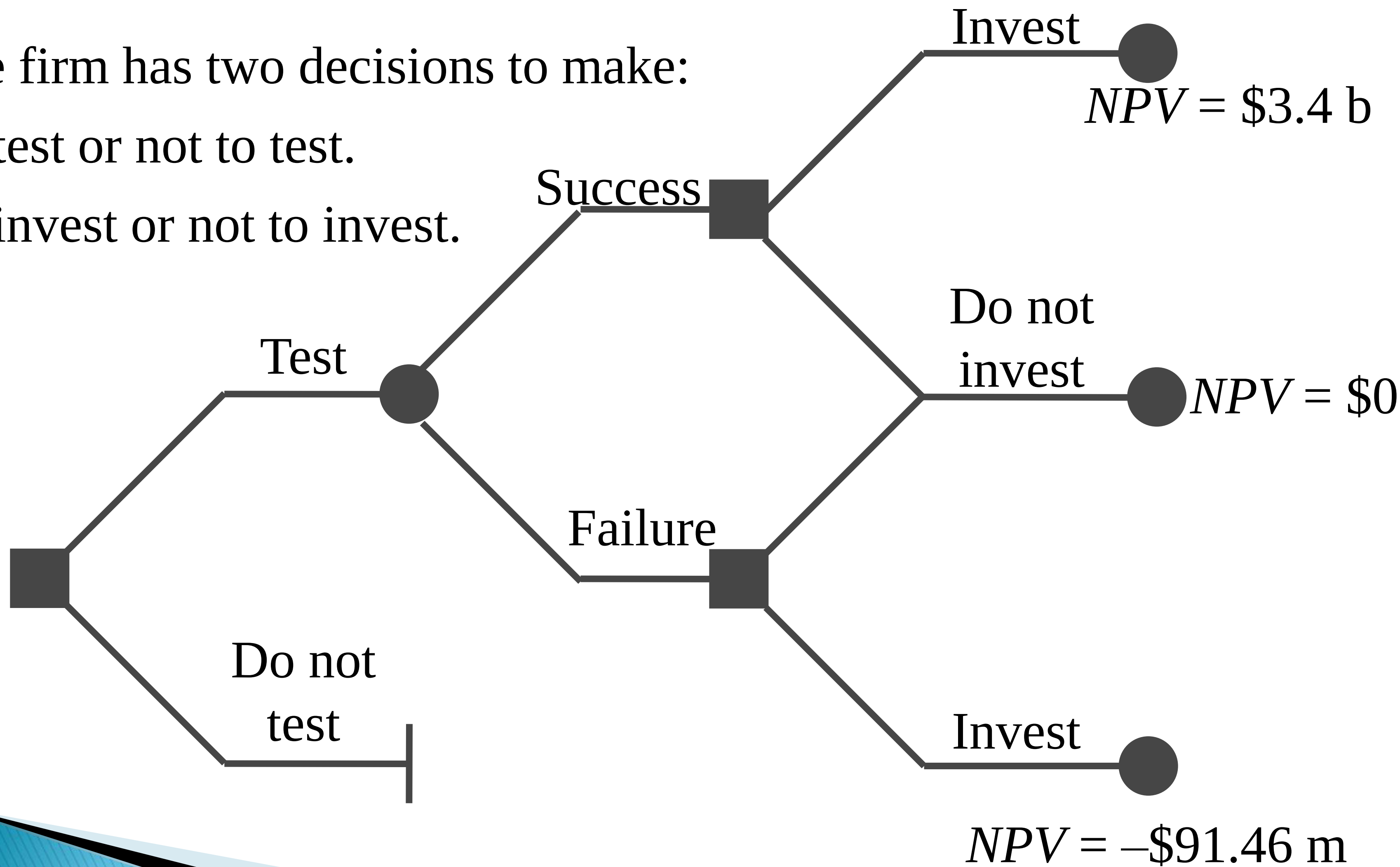
The lines leading away from the squares represent the alternatives.

Decision Tree for Stewart

The firm has two decisions to make:

To test or not to test.

To invest or not to invest.



Quick Quiz

- What are sensitivity analysis, scenario analysis, break-even analysis, and simulation?
- Why are these analyses important, and how should they be used?
- How do real options affect the value of capital projects?
- What information does a decision tree provide?

Lecture 6

Interest Rates and Bond Valuation
Stock Valuation

Bonds

8.1 Bonds and Bond Valuation

- A bond is a legally binding agreement between a borrower and a lender that specifies the:
  - Par (face) value
  - Coupon rate
  - Coupon payment
  - Maturity Date
- The yield to maturity is the required market interest rate on the bond.

Bond Valuation

- Primary Principle:
  - Value of financial securities = PV of expected future cash flows
- Bond value is, therefore, determined by the present value of the coupon payments and par value.
- Interest rates are inversely related to present (i.e., bond) values.

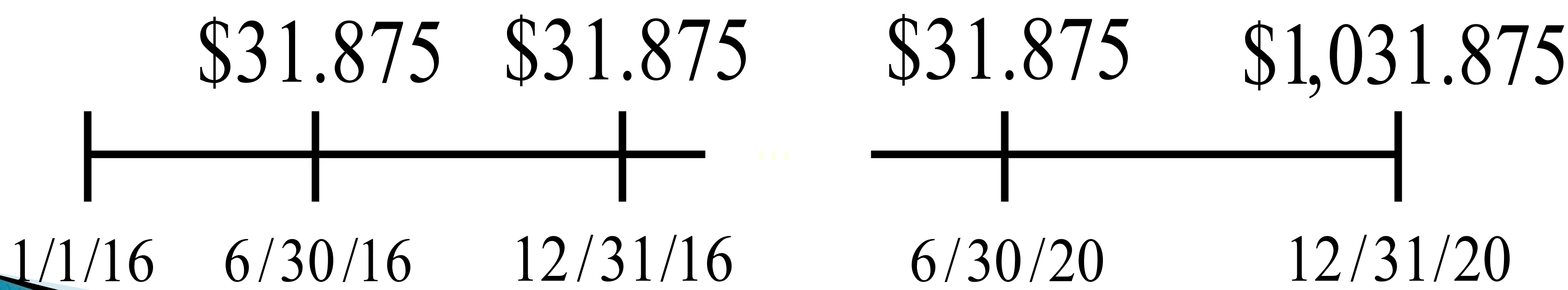
The Bond-Pricing Equation

$$P_B = \sum_{t=1}^{T} \frac{C}{(1+r)^t} + \frac{\text{Par Value}}{(1+r)^T}$$

$$\text{Price} = \text{Coupon} \times \frac{1}{r}\left[1 - \frac{1}{(1+r)^T}\right] + \text{Par value} \times \frac{1}{(1+r)^T}$$

Bond Example

- Consider a U.S. government bond with as 6 3/8% coupon that expires in December 2020.
  - The *Par Value* of the bond is $1,000.
  - *Coupon payments* are made semiannually (June 30 and December 31 for this particular bond).
  - Since the *coupon rate* is 6 3/8%, the semi-annual payment is $31.875.
  - On January 1, 2016 the size and timing of cash flows are:



Bond Example

- On January 1, 2016, the required yield is 5%.
- The current value is:

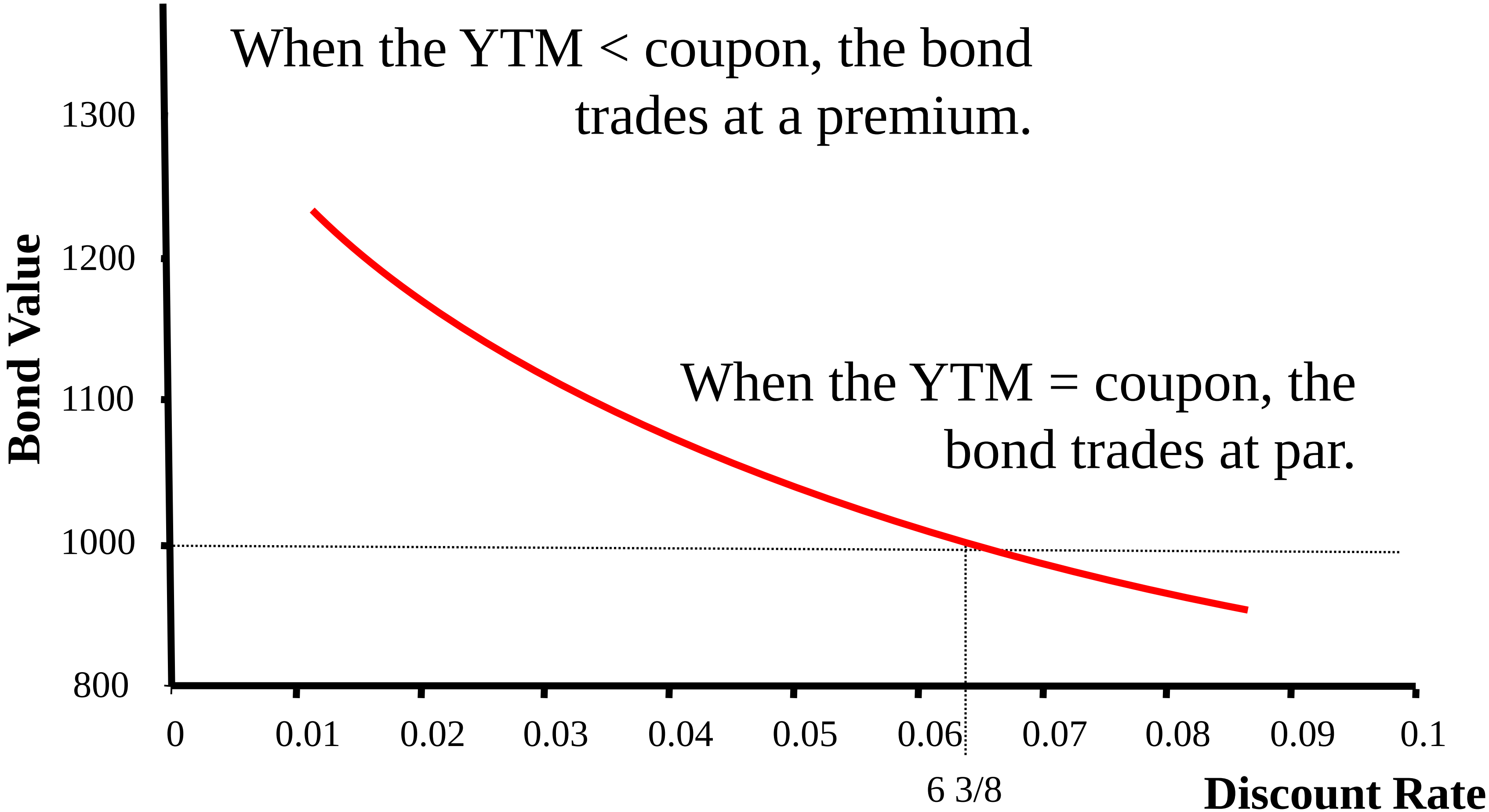
$$PV = \frac{\$31.875}{.05/2}\left[1 - \frac{1}{(1.025)^{10}}\right] + \frac{\$1{,}000}{(1.025)^{10}} = \$1{,}060.17$$

Bond Example

- Now assume that the required yield is 11%.
- How does this change the bond's price?

$$PV = \frac{\$31.875}{.11/2}\left[1 - \frac{1}{(1.055)^{10}}\right] + \frac{\$1,000}{(1.055)^{10}} = \$825.69$$

YTM and Bond Value



When the YTM > coupon, the bond trades at a discount.

Bond Concepts

- Bond prices and market interest rates move in opposite directions.
- When coupon rate = YTM, price = par value
- When coupon rate > YTM, price > par value (premium bond)
- When coupon rate < YTM, price < par value (discount bond)

Interest Rate Risk

- Price Risk
  - Change in price due to changes in interest rates
  - Long-term bonds have more price risk than short-term bonds
  - Low coupon rate bonds have more price risk than high coupon rate bonds.
- Reinvestment Rate Risk
  - Uncertainty concerning rates at which cash flows can be reinvested
  - Short-term bonds have more reinvestment rate risk than long-term bonds.
  - High coupon rate bonds have more reinvestment rate risk than low coupon rate bonds.

YTM with Semiannual Coupons

- Suppose a bond with a 10% coupon rate and semiannual coupons has a face value of $1,000, 20 years to maturity, and is selling for $1,197.93.
  - Is the YTM more or less than 10%?
  - What is the semi-annual coupon payment?
  - How many periods are there?
  - N = 40; PV = -1,197.93; PMT = 50; FV = 1,000; CPT I/Y = 4% (Is this the YTM?)
  - YTM = 4%*2 = 8%

Current Yield vs. Yield to Maturity

- Current Yield = annual coupon / price
- Yield to maturity = current yield + capital gains yield
- Example: 10% coupon bond, with semi-annual coupons, face value of 1,000, 20 years to maturity, $1,197.93 price
  - Current yield = 100 / 1197.93 = .0835 = 8.35%
  - Price in one year, assuming no change in YTM = 1,193.68
  - Capital gain yield = (1193.68 – 1197.93) / 1197.93 = -.0035 = -.35%
  - YTM = 8.35 - .35 = 8%, which is the same YTM computed earlier

Bond Pricing Theorems

- Bonds of similar risk (and maturity) will be priced to yield about the same return, regardless of the coupon rate.
- If you know the price of one bond, you can estimate its YTM and use that to find the price of the second bond.
- This is a useful concept that can be transferred to valuing assets other than bonds.

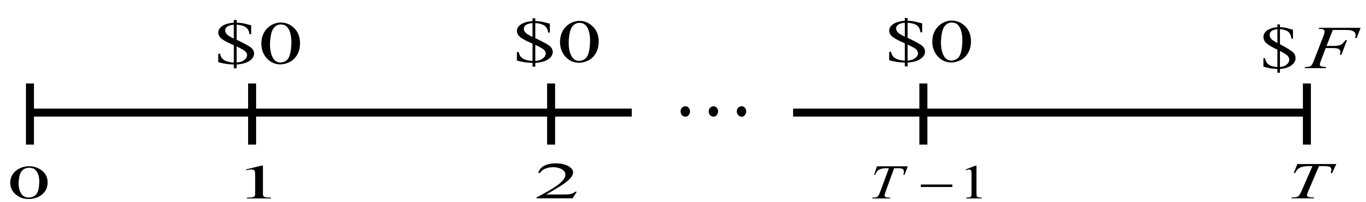
Zero Coupon Bonds

- Make no periodic interest payments (coupon rate = 0%)
- The entire yield to maturity comes from the difference between the purchase price and the par value
- Cannot sell for more than par value
- Sometimes called zeroes, deep discount bonds, or original issue discount bonds (OIDs)
- Treasury Bills and principal-only Treasury strips are good examples of zeroes

Pure Discount Bonds

Information needed for valuing pure discount bonds:

- Time to maturity (T) = Maturity date - today's date
- Face value (F)
- Discount rate (r)

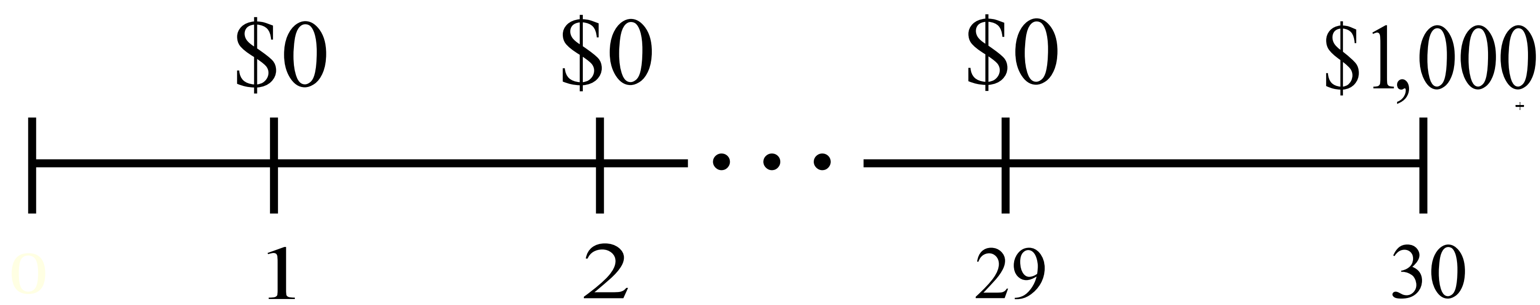


Present value of a pure discount bond at time 0:

$$PV = \frac{F}{(1+r)^T}$$

Pure Discount Bonds: Example

Find the value of a 15-year zero-coupon bond with a $1,000 par value and a YTM of 12%.



$$PV = \frac{F}{(1+r)^T} = \frac{\$1{,}000}{(1.06)^{30}} = \$174.11$$

8.2 Government Bonds

- Treasury Securities
  - Federal government debt
  - T-bills – pure discount bonds with original maturity less than one year
  - T-notes – coupon debt with original maturity between one and ten years
  - T-bonds – coupon debt with original maturity greater than ten years
- Municipal Securities
  - Debt of state and local governments
  - Varying degrees of default risk, rated similar to corporate debt
  - Interest received is tax-exempt at the federal level

After-tax Yields

- A taxable bond has a yield of 8%, and a municipal bond has a yield of 6%.
  - If you are in a 40% tax bracket, which bond do you prefer?
    - 8%(1 - .4) = 4.8%
    - The after-tax return on the corporate bond is 4.8%, compared to a 6% return on the municipal
  - At what tax rate would you be indifferent between the two bonds?
    - 8%(1 – T) = 6%
    - T = 25%

Corporate Bonds

- Greater default risk relative to government bonds
- The promised yield (YTM) may be higher than the expected return due to this added default risk

Bond Ratings – Investment Quality

- High Grade
  - Moody's Aaa and S&P AAA – capacity to pay is extremely strong
  - Moody's Aa and S&P AA – capacity to pay is very strong
- Medium Grade
  - Moody's A and S&P A – capacity to pay is strong, but more susceptible to changes in circumstances
  - Moody's Baa and S&P BBB – capacity to pay is adequate, adverse conditions will have more impact on the firm's ability to pay

Bond Ratings – Speculative

- Low Grade
  - Moody's Ba and B
  - S&P BB and B
  - Considered speculative with respect to capacity to pay.
- Very Low Grade
  - Moody's C
  - S&P C & D
  - Highly uncertain repayment and, in many cases, already in default, with principal and interest in arrears.

8.3 Bond Markets

- Primarily over-the-counter transactions with dealers connected electronically
- Extremely large number of bond issues, but generally low daily volume in single issues
- Makes getting up-to-date prices difficult, particularly on a small company or municipal issues
- Treasury securities are an exception

Treasury Quotations

2023 May15	1.750	97.1953	97.2109	0.3438	2.113

- What is the coupon rate on the bond?
- When does the bond mature?
- What is the bid price? What does this mean?
- What is the ask price? What does this mean?
- How much did the price change from the previous day?
- What is the yield based on the ask price?

Clean versus Dirty Prices

- Clean price: quoted price
- Dirty price: price actually paid = quoted price plus accrued interest
- Example: Consider the T-bond in the previous slide and assume today is January 15:
  - Number of days since last coupon = 61
  - Number of days in the coupon period = 181
  - Accrued interest = (61/181)(.0175/2*1,000) = $2.95
- Prices (based on ask):
  - Clean price = 972.11
  - Dirty price = 972.11 + 2.95 = 975.06
- So, you would actually pay $975.06 per $1,000 par value bond.

8.4 Inflation and Interest Rates

- Real rate of interest – change in purchasing power
- Nominal rate of interest – quoted rate of interest, change in purchasing power and inflation
- The *ex ante* nominal rate of interest includes our desired real rate of return plus an adjustment for expected inflation.

Real versus Nominal Rates

- $(1 + R) = (1 + r)(1 + h)$, where
  - R = nominal rate
  - r = real rate
  - h = expected inflation rate
- Approximation
  - $R = r + h$

Inflation-Linked Bonds

- Most government bonds face inflation risk
- TIPS (Treasury Inflation-Protected Securities), however, eliminate this risk by providing promised payments specified in real, rather than nominal, terms

The Fisher Effect: Example

- If we require a 10% real return and we expect inflation to be 8%, what is the nominal rate?
- R = (1.1)(1.08) – 1 = .188 = 18.8%
- Approximation: R = 10% + 8% = 18%
- Because the real return and expected inflation are relatively high, there is a significant difference between the actual Fisher Effect and the approximation.

8.5 Determinants of Bond Yields

- Term structure is the relationship between time to maturity and yields, all else equal.
- It is important to recognize that we pull out the effect of default risk, different coupons, etc.
- Yield curve – graphical representation of the term structure
  - Normal – upward-sloping, long-term yields are higher than short-term yields
  - Inverted – downward-sloping, long-term yields are lower than short-term yields

Factors Affecting Required Return

- Default risk premium – remember bond ratings
- Taxability premium – remember municipal versus taxable
- Liquidity premium – bonds that have more frequent trading will generally have lower required returns (remember bid-ask spreads)
- Anything else that affects the risk of the cash flows to the bondholders will affect the required returns.

Stocks

9.1 The PV of Common Stocks

- The value of any asset is the present value of its expected future cash flows.
- Stock ownership produces cash flows from:
  - Dividends
  - Capital Gains
- Valuation of Different Types of Stocks
  - Zero Growth
  - Constant Growth
  - Differential Growth

Case 1: Zero Growth

- Assume that dividends will remain at the same level forever

$$\text{Div}_1 = \text{Div}_2 = \text{Div}_3 = \cdots$$

  - Since future cash flows are constant, the value of a zero growth stock is the present value of a perpetuity:

$$P_0 = \frac{\text{Div}_1}{(1+R)^1} + \frac{\text{Div}_2}{(1+R)^2} + \frac{\text{Div}_3}{(1+R)^3} + \cdots$$

$$P_0 = \frac{\text{Div}}{R}$$

Case 2: Constant Growth

Assume that dividends will grow at a constant rate, *g*, forever, *i.e.*,

$$\text{Div}_1 = \text{Div}_0(1+g)$$

$$\text{Div}_2 = \text{Div}_1(1+g) = \text{Div}_0(1+g)^2$$

$$\text{Div}_3 = \text{Div}_2(1+g) = \text{Div}_0(1+g)^3$$

Since future cash flows grow at a constant rate forever, the value of a constant growth stock is the present value of a growing perpetuity:

$$P_0 = \frac{\text{Div}_1}{R-g}$$

Constant Growth Example

- Suppose Big D, Inc., just paid a dividend of $.50. It is expected to increase its dividend by 2% per year. If the market requires a return of 15% on assets of this risk level, how much should the stock be selling for?
- P_0 = .50(1+.02) / (.15 - .02) = $3.92

Case 3: Differential Growth

- Assume that dividends will grow at different rates in the foreseeable future and then will grow at a constant rate thereafter.
- To value a Differential Growth Stock, we need to:
  - Estimate future dividends in the foreseeable future.
  - Estimate the future stock price when the stock becomes a Constant Growth Stock (case 2).
  - Compute the total present value of the estimated future dividends and future stock price at the appropriate discount rate.

Case 3: Differential Growth

- Assume that dividends will grow at rate g_1 for N years and grow at rate g_2 thereafter.

$$\text{Div}_1 = \text{Div}_0(1+g_1)$$

$$\text{Div}_2 = \text{Div}_1(1+g_1) = \text{Div}_0(1+g_1)^2$$

$$\vdots$$

$$\text{Div}_N = \text{Div}_{N-1}(1+g_1) = \text{Div}_0(1+g_1)^N$$

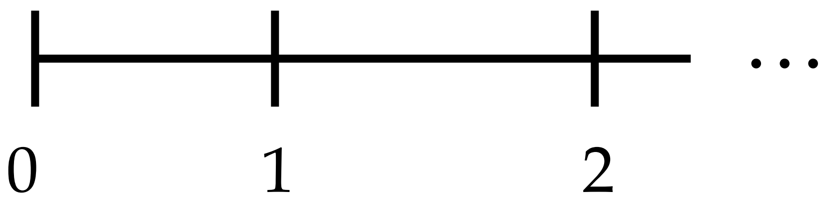
$$\text{Div}_{N+1} = \text{Div}_N(1+g_2) = \text{Div}_0(1+g_1)^N(1+g_2)$$

$$\vdots$$

Case 3: Differential Growth

Dividends will grow at rate g_1 for N years and grow at rate g_2 thereafter

$$\mathrm{Div}_0(1+g_1) \qquad \mathrm{Div}_0(1+g_1)^2$$



$$\mathrm{Div}_0(1+g_1)^N$$

$$\mathrm{Div}_N(1+g_2) = \mathrm{Div}_0(1+g_1)^N(1+g_2)$$

Case 3: Differential Growth

We can value this as the sum of:

- a T-year annuity growing at rate g_1

$$P_A = \frac{C}{R - g_1}\left[1 - \frac{(1+g_1)^T}{(1+R)^T}\right]$$

- plus the discounted value of a perpetuity growing at rate g_2 that starts in year T+1

$$P_B = \frac{\left(\dfrac{\text{Div}_{\text{T}+1}}{R - g_2}\right)}{(1+R)^T}$$

Case 3: Differential Growth

Consolidating gives:

$$P = \frac{C}{R - g_1}\left[1 - \frac{(1+g_1)^T}{(1+R)^T}\right] + \frac{\left(\dfrac{\text{Div}_{T+1}}{R - g_2}\right)}{(1+R)^T}$$

A Differential Growth Example

A common stock just paid a dividend of $2. The dividend is expected to grow at 8% for 3 years, then it will grow at 4% in perpetuity.

What is the stock worth? The discount rate is 12%.

With the Formula

$$P = \frac{\$2 \times (1.08)}{.12 - .08}\left[1 - \frac{(1.08)^3}{(1.12)^3}\right] + \frac{\left(\dfrac{\$2(1.08)^3(1.04)}{.12 - .04}\right)}{(1.12)^3}$$

$$P = \$54 \times [1 - .8966] + \frac{(\$32.75)}{(1.12)^3}$$

$$P = \$5.58 + \$23.31 \qquad P = \$28.89$$

9.2 Estimates of Parameters

- The value of a firm depends upon its growth rate, g, and its discount rate, R.
  - Where does g come from?

    g = Retention ratio × Return on retained earnings

Where Does *R* Come From?

- The discount rate can be broken into two parts.
  - The dividend yield
  - The growth rate (in dividends)
- In practice, there is a great deal of estimation error involved in estimating *R*.

Using the DGM to Find R

- Start with the DGM:

$$P_0 = \frac{D_0(1+g)}{R - g} = \frac{D_1}{R - g}$$

Rearrange and solve for R:

$$R = \frac{D_0(1+g)}{P_0} + g = \frac{D_1}{P_0} + g$$

9.3 Comparables

- Comparables are used to value companies based primarily on multiples.
- Common multiples include:
  - Price-to-Earnings
  - Enterprise Value Ratios

Price–Earnings Ratio

- The price-earnings ratio is calculated as the current stock price divided by annual EPS.
  - *The Wall Street Journal* uses last 4 quarter's earnings

$$\text{P/E ratio} = \frac{\text{Price per share}}{EPS}$$

Enterprise Value Ratios

- The PE ratio focuses on equity, but what if we want the value of the firm?
- Use Enterprise Value:
  - EV = market value of equity + market value of debt - cash
- Like PE, we compare the value to a measure of earnings. From a firm level, this is EBITDA, or earnings before interest, taxes, depreciation, and amortization.
  - EBITDA represents a measure of total firm cash flow
- The Enterprise Value Ratio = EV / EBITDA

9.4 Valuing Stocks Using Free Cash Flows

- In Chapters 5 and 6 you learned that the value of a project (i.e., its NPV) was the discounted value of the cash flows it generates.
- The firm is the consolidated present value of the cash flow from all of its projects.

9.5 The Stock Markets

- Dealers vs. Brokers
- New York Stock Exchange (NYSE)
  - Largest stock market in the world
  - License Holders (formerly "Members")
    - Entitled to buy or sell on the exchange floor
  - Operations
  - Floor activity

Market and Limit Orders

- Market orders:
  - You specify ticker and quantity
  - Immediate execution at best available price
    - Market buy will be executed at lowest ask
    - Market sell will be executed at highest bid
- Limit orders:
  - You specify ticker, quantity, and price
  - The order will be executed only if trade can be made at the limit price or better
    - Limit Buy can only be executed at limit price or lower
    - Limit Sell can only be executed at limit price or higher

Stop Orders

- The Stop price is the trigger or activation point.
  - If the stop price is reached or passed, the order becomes a market order to be executed at the best available price.
  - Risk: price suddenly plummets or rises and the execution price is much different than expected.

NASDAQ

- Not a physical exchange – computer-based quotation system
- Multiple market makers
- Electronic Communications Networks
- Three levels of information
  - Level 1 – median quotes, registered representatives
  - Level 2 – view quotes, brokers & dealers
  - Level 3 – view and update quotes, dealers only
- Large portion of technology stocks

Stock Market Reporting

52	WEEKS				YLD		VOL		NET
HI	LO	STOCK	SYM	DIV	%	PE	100s	CLOSE	CHG
21.89	9.41	Gap Inc	GPS	0.34	3.1	8	88298	11.06	0.45

Gap has been as high as $21.89 in the last year.

Gap has been as low as $9.41 in the last year.

Gap pays a dividend of 34 cents/share.

Given the current price, the dividend yield is 3.1%.

Given the current price, the PE ratio is 8 times earnings.

8,829,800 shares traded hands in the last day's trading.

Gap ended trading at $11.06, which is up 45 cents from yesterday.

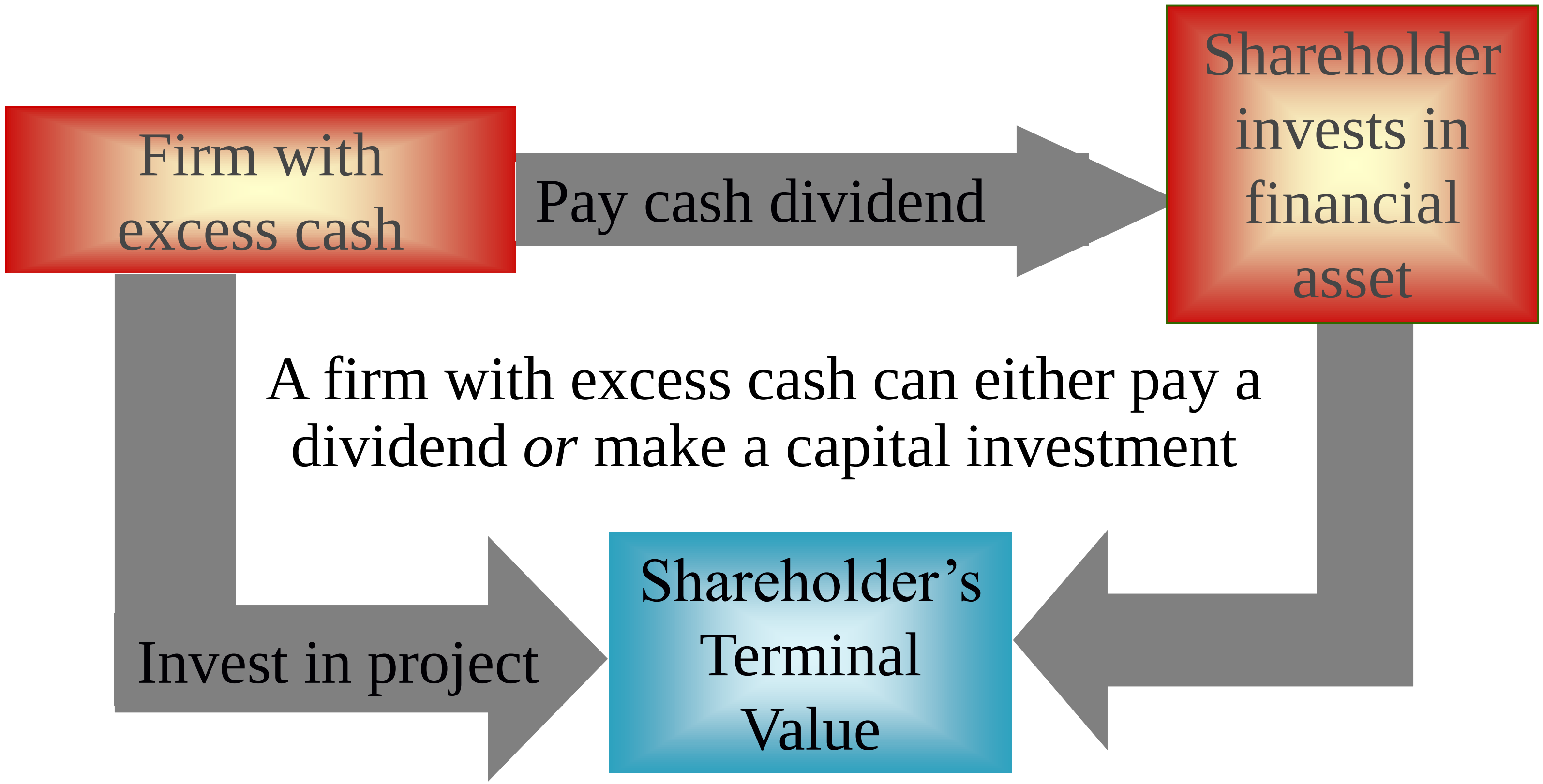
Lecture 7

Risk, Cost of Capital, and Valuation

Where Do We Stand?

- Earlier chapters on capital budgeting focused on the appropriate size and timing of cash flows.
- This chapter discusses the appropriate discount rate when cash flows are risky.

13.1 The Cost of Equity Capital



Because stockholders can reinvest the dividend in risky financial assets, the expected return on a capital-budgeting project should be at least as great as the expected return on a financial asset of comparable risk.

Risk When Holding the Market Portfolio

- Researchers have shown that the best measure of the risk of a security in a large portfolio is the *beta* (β) of the security.
- Beta measures the responsiveness of a security to movements in the market portfolio (i.e., systematic risk).

$$\beta_i = \frac{Cov(R_{i,} R_M)}{\sigma^2(R_M)}$$

Example with GE as individual security (Econ233)

Portfolio Weights	w_1	w_2	...	w_{GE}	...	w_n
w_1	$Cov(R_1, R_1)$	$Cov(R_1, R_2)$	...	$Cov(R_1, R_{GE})$	...	$Cov(R_1, R_n)$
w_2	$Cov(R_2, R_1)$	$Cov(R_2, R_2)$	...	$Cov(R_2, R_{GE})$	...	$Cov(R_2, R_n)$
⋮	⋮	⋮		⋮		⋮
w_{GE}	$Cov(R_{GE}, R_1)$	$Cov(R_{GE}, R_2)$	...	$Cov(R_{GE}, R_{GE})$	...	$Cov(R_{GE}, R_n)$
⋮	⋮	⋮		⋮		⋮
w_n	$Cov(R_n, R_1)$	$Cov(R_n, R_2)$	...	$Cov(R_n, R_{GE})$	...	$Cov(R_n, R_n)$

- Contribution of GE's stock to variance of market portfolio is

$$w_{GE}[w_1 \mathrm{Cov}(R_1, R_{GE}) + w_2 \mathrm{Cov}(R_2, R_{GE}) + \ldots + w_{GE} \mathrm{Cov}(R_{GE}, R_{GE}) + \ldots + w_n \mathrm{Cov}(R_n, R_{GE})]$$

GE Example

- Covariance of GE return with the market portfolio:

$$\sum_{i=1}^{n} w_i Cov\,(R_i\,, R_{GE}) = \sum_{i=1}^{n} Cov\,(w_i R_i\,, R_{GE}) = Cov\left(\sum_{i=1}^{n} w_i R_i\,, R_{GE}\right)$$

- But $\sum_{i=1}^{n} w_i R_i = R_M$, so $\sum_{i=1}^{n} w_i \mathrm{Cov}(R_i, R_{\mathrm{GE}}) = \mathrm{Cov}(R_M, R_{\mathrm{GE}})$

- Therefore, the reward-to-risk ratio for investments in GE would be:

$$\frac{GE's\ contribution\ to\ risk\ premium}{GE's\ contribution\ to\ variance} = \frac{w_{GE}E(R_{GE})}{w_{GE}Cov(R_{GE}, R_M)} = \frac{E(R_{GE})}{Cov(R_{GE}, R_M)}$$

GE Example

- Reward-to-risk ratio for investment in market portfolio:

$$\frac{\textit{Market risk premium}}{\textit{Market variance}} = \frac{E(R_M)}{\sigma_M^2}$$

- Market pressure implies that the reward-to-risk ratios of GE and the market portfolio should be equal:

$$\frac{E(R_{GE})}{Cov(R_{GE}, R_M)} = \frac{E(R_M)}{\sigma_M^2}$$

GE Example

- The risk premium for GE is therefore:

$$E(R_{GE}) = \frac{Cov(R_{GE}, R_M)}{\sigma_M^2} E(R_M)$$

- The quantity $\frac{\mathrm{Cov}(R_{\mathrm{GE}}, R_M)}{\sigma_M^2}$ is termed GE's "beta",

  or β_{GE}

- Restating, we obtain:

$$E(r_{GE}) = r_f + \beta_{GE}\left[E(r_M) - r_f\right]$$

The Cost of Equity Capital

- From the firm's perspective, the expected return is the Cost of Equity Capital:

$$\overline{R}_s = R_F + \beta_s(\overline{R}_M - R_F)$$

Different notation than Econ 233

- To estimate a firm's cost of equity capital, we need to know three things:

1. The risk-free rate, R_F
2. The market risk premium, $\overline{R}_M - R_F$
3. The company beta, $\beta_i = \dfrac{Cov(R_i, R_M)}{Var(R_M)} = \dfrac{\sigma_{i,M}}{\sigma_M^2}$

Example

- Suppose the stock of Stansfield Enterprises, a publisher of PowerPoint presentations, has a beta of 1.5. The firm is 100% equity financed.
- Assume a risk-free rate of 3% and a market risk premium of 7%.
- What is the appropriate discount rate for an expansion of this firm?

$$\bar{R}_S = R_F + \beta_S(\bar{R}_M - R_F)$$

$$\bar{R}_S = 3\% + 1.5 \times 7\%$$

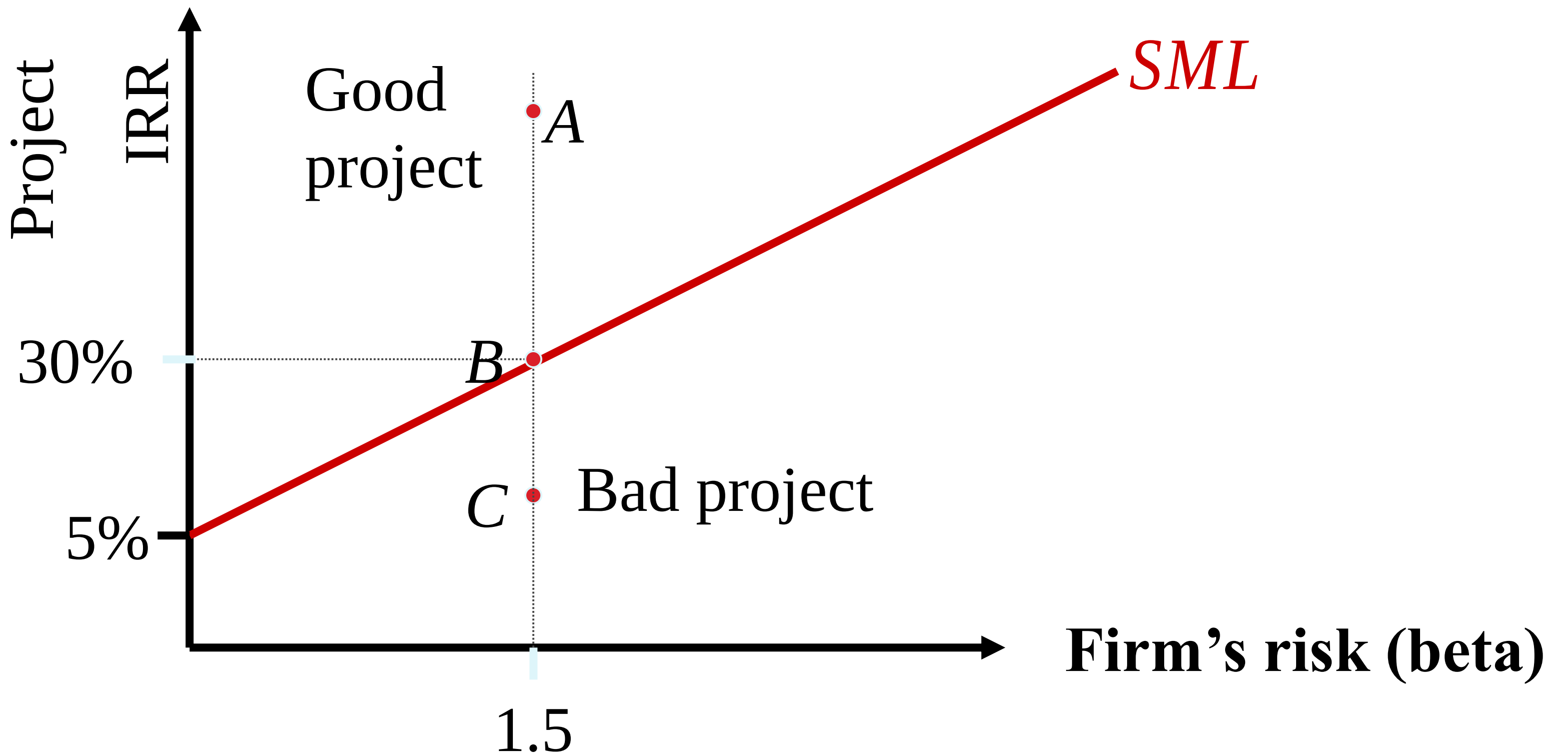
$$\bar{R}_S = 13.5\%$$

Example

Suppose Stansfield Enterprises is evaluating the following independent projects. Each costs $100 and lasts one year.

Project	Project β	Project's Estimated Cash Flows Next Year	IRR	NPV at 13.5%
A	1.5	$125	25%	$10.13
B	1.5	$113.5	13.5%	$0
C	1.5	$105	5%	-$7.49

Using the SML



An all-equity firm should accept projects whose IRRs exceed the cost of equity capital and reject projects whose IRRs fall short of the cost of capital.

The Risk-Free Rate

- Treasury securities are close proxies for the risk-free rate.
- The CAPM is a period model. However, projects are long-lived. So, average period (short-term) rates need to be used.
- The historic premium of long-term (20-year) rates over short-term rates for government securities is in the range of 1-2%.
- So, the risk-free rate to be used in the CAPM could be estimated as 2% below the prevailing rate on 20-year treasury securities.

Market Risk Premium

- Method 1: Use historical data
- Method 2: Use the Dividend Discount Model

$$R_s = \frac{D_1}{P} + g$$

  - Market data and analyst forecasts can be used to implement the DDM approach on a market-wide basis

13.3 Estimation of Beta

Market Portfolio - Portfolio of all assets in the economy. In practice, a broad stock market index, such as the S&P 500, is used to *represent* the market.

Beta - Sensitivity of a stock's return to the return on the market portfolio.

Estimation of Beta

$$\beta = \frac{Cov(R_i, R_M)}{Var(R_M)}$$

- Problems
  1. Betas may vary over time.
  2. The sample size may be inadequate.
  3. Betas are influenced by changing financial leverage and business risk.
- Solutions
  - Problems 1 and 2 can be moderated by more sophisticated statistical techniques.
  - Problem 3 can be lessened by adjusting for changes in business and financial risk.
  - Look at average beta estimates of comparable firms in the industry.

Stability of Beta

- Most analysts argue that betas are generally stable for firms remaining in the same industry.
- That is not to say that a firm's beta cannot change.
  - Changes in product line
  - Changes in technology
  - Deregulation
  - Changes in financial leverage

Using an Industry Beta

- It is frequently argued that one can better estimate a firm's beta by involving the whole industry.
- If you believe that the operations of the firm are similar to the operations of the rest of the industry, you should use the industry beta.
- If you believe that the operations of the firm are fundamentally different from the operations of the rest of the industry, you should use the firm's beta.
- Do not forget about adjustments for financial leverage.

13.4 Determinants of Beta

- Business Risk
  - Cyclicality of Revenues
  - Operating Leverage
- Financial Risk
  - Financial Leverage

Cyclicality of Revenues

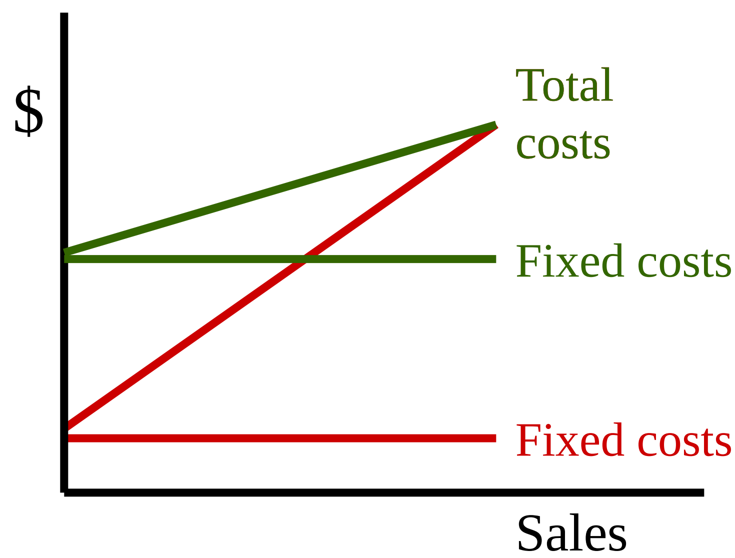
- Highly cyclical stocks have higher betas.
  - Empirical evidence suggests that retailers and automotive firms fluctuate with the business cycle.
  - Transportation firms and utilities are less dependent on the business cycle.
- Note that cyclicality is not the same as variability—stocks with high standard deviations need not have high betas.
  - Movie studios have revenues that are variable, depending upon whether they produce "hits" or "flops," but their revenues may not be especially dependent upon the business cycle.

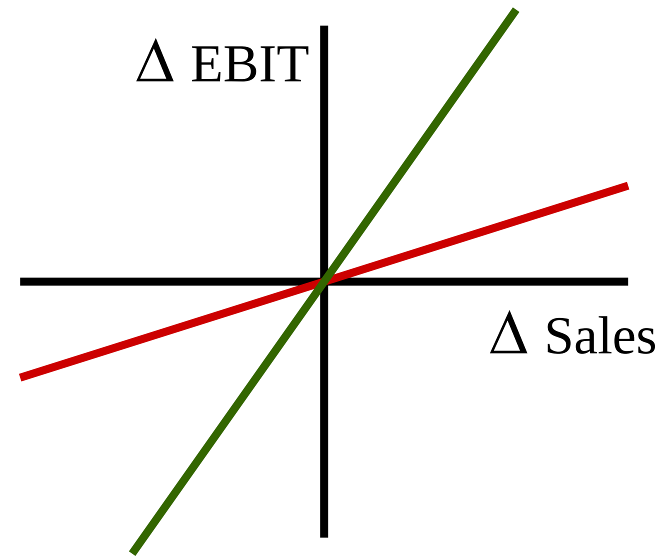
Operating Leverage

- The degree of operating leverage measures how sensitive a firm (or project) is to its fixed costs.
- Operating leverage increases as fixed costs rise and variable costs fall.
- Operating leverage magnifies the effect of cyclicality on beta.
- The degree of operating leverage is given by:

$$DOL = \frac{\Delta \text{ EBIT}}{EBIT} \times \frac{\text{Sales}}{\Delta \text{ Sales}}$$

Operating Leverage





Operating leverage increases as fixed costs rise and variable costs fall.

Financial Leverage and Beta

- Operating leverage refers to the sensitivity to the firm's fixed costs of *production*.
- Financial leverage is the sensitivity to a firm's fixed costs of *financing*.
- The relationship between the betas of the firm's debt, equity, and assets is given by:

$$\beta_{Asset} = \frac{\text{Debt}}{\text{Debt + Equity}} \times \beta_{Debt} + \frac{\text{Equity}}{\text{Debt + Equity}} \times \beta_{Equity}$$

- Financial leverage always increases the equity beta relative to the asset beta.

Example

Consider Grand Sport, Inc., which is currently all-equity financed and has a beta of 0.90.

The firm has decided to lever up to a capital structure of 1 part debt to 1 part equity.

Since the firm will remain in the same industry, its asset beta should remain 0.90.

However, assuming a zero beta for its debt, its equity beta would become twice as large:

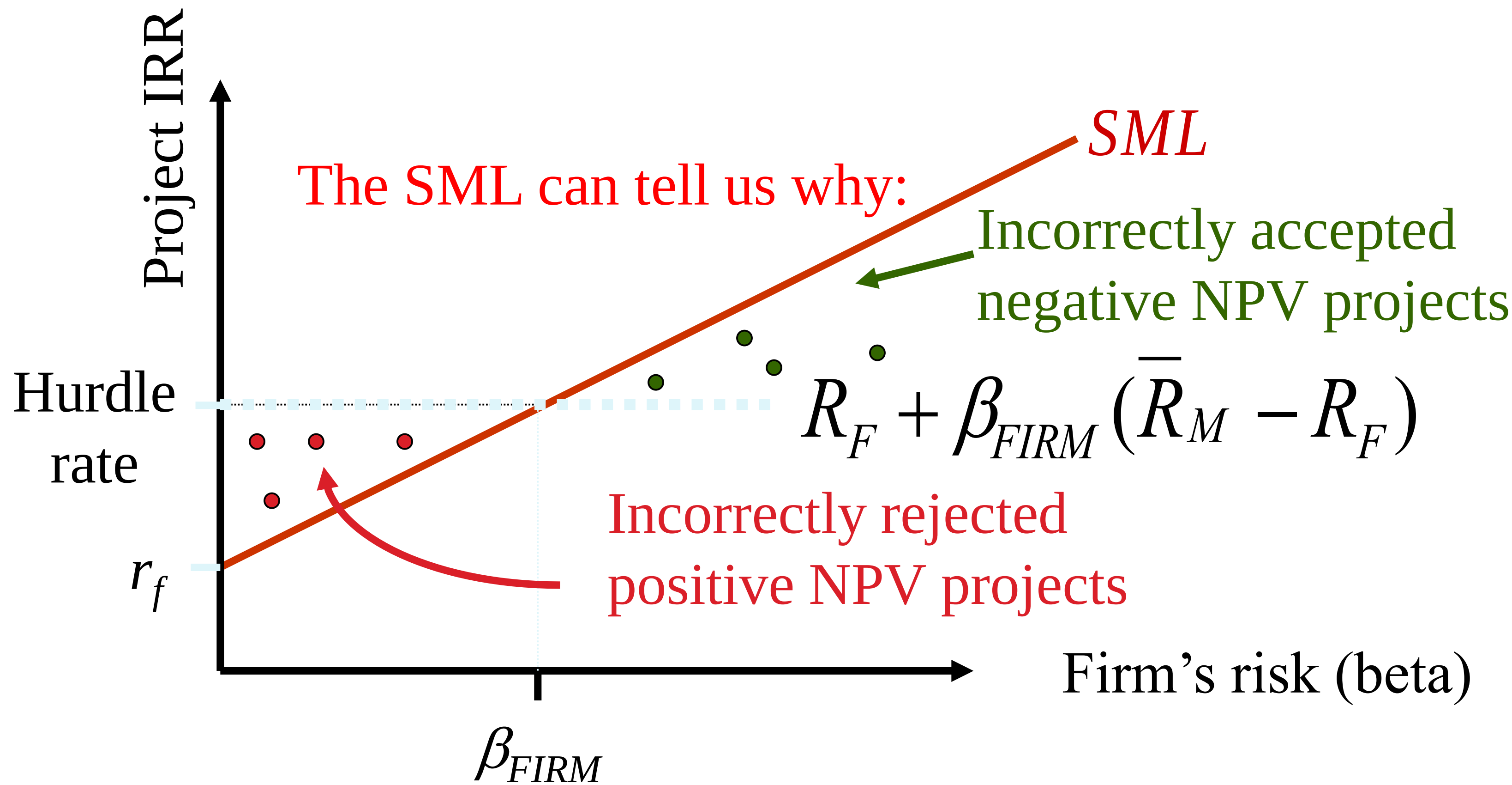
$$\beta_{Asset} = 0.90 = \frac{1}{1+1} \times \beta_{Equity} \qquad \beta_{Equity} = 2 \times 0.90 = 1.80$$

13.5 Dividend Discount Model

$$R_s = \frac{D_1}{P} + g$$

- The DDM is an alternative to the CAPM for calculating a firm's cost of equity.
- The DDM and CAPM are internally consistent, but academics generally favor the CAPM and companies seem to use the CAPM more consistently.
  - The CAPM explicitly adjusts for risk and it can be used on companies that do not pay dividends.

Capital Budgeting & Project Risk



A firm that uses one discount rate for all projects may over time increase the risk of the firm while decreasing its value.

Capital Budgeting & Project Risk

Suppose the Conglomerate Company has a cost of capital, based on the CAPM, of 11.1%. The risk-free rate is 2%, the market risk premium is 7%, and the firm's beta is 1.3.

$$11.1\% = 2\% + 1.3 \times 7\%$$

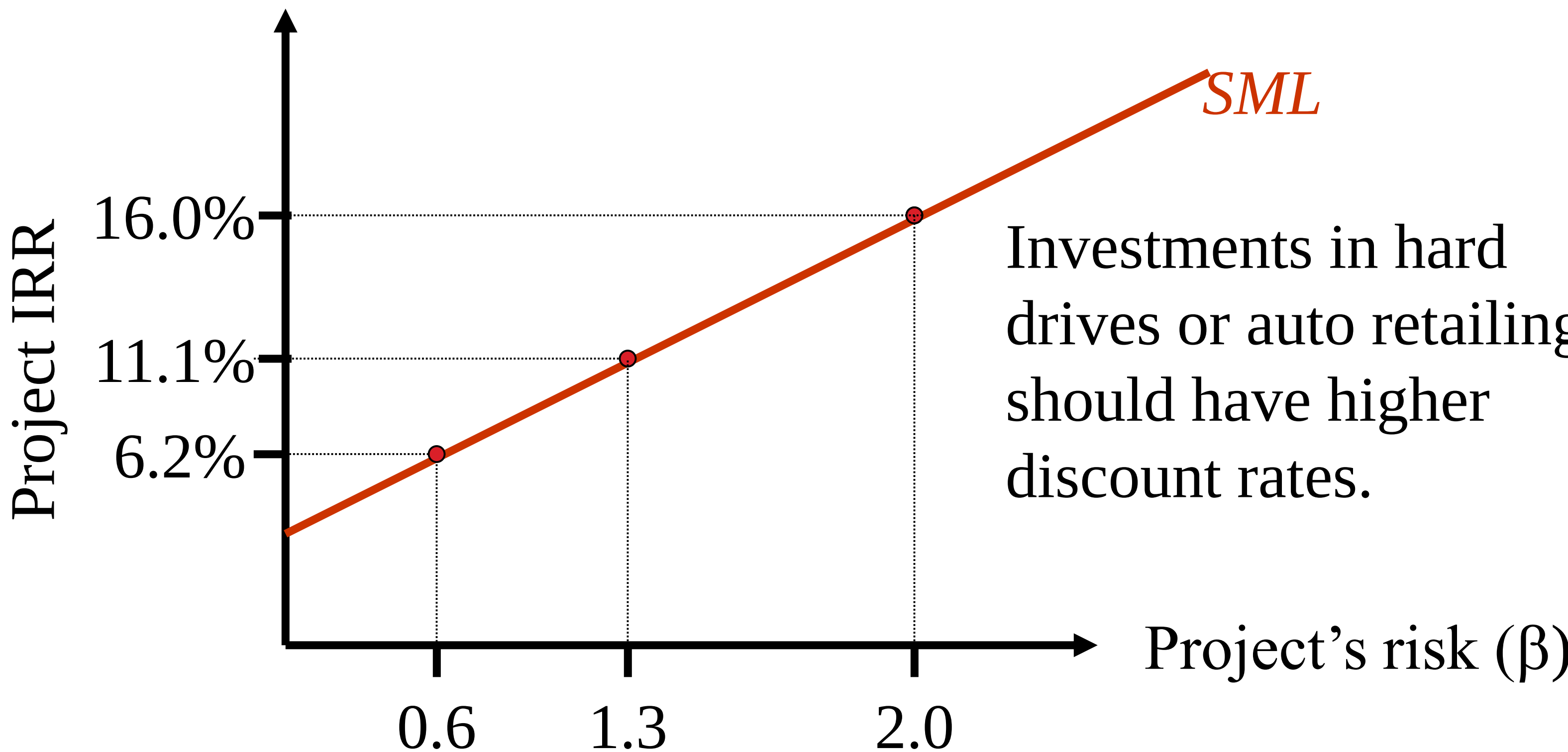
This is a breakdown of the company's investment projects:

1/3 Automotive Retailer	$\beta = 2.0$
1/3 Computer Hard Drive Manufacturer	$\beta = 1.3$
1/3 Electric Utility	$\beta = 0.6$

average β of assets = 1.3

When evaluating a new electrical generation investment, which cost of capital should be used?

Capital Budgeting & Project Risk



Investments in hard drives or auto retailing should have higher discount rates.

$$R = 2\% + 0.6 \times (7\%) = 6.2\%$$

6.2% reflects the opportunity cost of capital on an investment in electrical generation, given the unique risk of the project.

Cost of Debt

- Interest rate required on new debt issuance (i.e., yield to maturity on outstanding debt)
- Adjust for the tax deductibility of interest expense

Cost of Preferred Stock

- Preferred stock is a perpetuity, so its price is equal to the coupon paid divided by the current required return.
- Rearranging, the cost of preferred stock is:
  - $R_P = C / PV$

13.8 The Weighted Average Cost of Capital

- The Weighted Average Cost of Capital is given by:

$$R_{WACC} = \frac{\text{Equity}}{\text{Equity} + \text{Debt}} \times R_{Equity} + \frac{\text{Debt}}{\text{Equity} + \text{Debt}} \times R_{Debt} \times (1 - T_C)$$

$$R_{WACC} = \frac{S}{S + B} \times R_S + \frac{B}{S + B} \times R_B \times (1 - T_C)$$

- Because interest expense is tax-deductible, we multiply the last term by $(1 - T_C)$.

Firm Valuation

- The value of the firm is the present value of expected future (distributable) cash flow discounted at the WACC
- To find equity value, subtract the value of the debt from the firm value

Example: International Paper

- First, we estimate the cost of equity and the cost of debt.
  - We estimate an equity beta to estimate the cost of equity.
  - We can often estimate the cost of debt by observing the YTM of the firm's debt.
- Second, we determine the WACC by weighting these two costs appropriately.

Example: International Paper

- The industry average beta is 0.82, the risk free rate is 2%, and the market risk premium is 7%.
- Thus, the cost of equity capital is:

$$R_S = R_F + \beta_i \times (\overline{R}_M - R_F)$$

$$= 2\% + 0.82 \times 7\%$$

$$= 7.74\%$$

Example: International Paper

- The yield on the company's debt is 5%, and the firm has a 35% marginal tax rate.
- The debt to value ratio is 32%

$$R_{WACC} = \frac{S}{S+B} \times R_S + \frac{B}{S+B} \times R_B \times (1 - T_C)$$

$$= 0.68 \times 7.74\% + 0.32 \times 5\% \times (1 - 0.35)$$

$$= 6.30\%$$

6.30% is International's cost of capital (i.e., WACC). It should be used to discount any project where one believes that the project's risk is equal to the risk of the firm as a whole and the project has the same leverage as the firm as a whole.

13.11 Flotation Costs

- Flotation costs represent the expenses incurred upon the issue, or float, of new bonds or stocks.
- These are incremental cash flows of the project, which typically reduce the NPV since they increase the initial project cost (i.e., CF_0).

  Amount Raised = Necessary Proceeds / (1-% flotation cost)

- The % flotation cost is a weighted average based on the average cost of issuance for each funding source and the firm's target capital structure:

$$f_A = (E/V)^* f_E + (D/V)^* f_D$$

Lecture 8

Efficient Capital Markets and Behavioral Challenges

14.1 Can Financing Decisions Create Value?

- Earlier parts of the book show how to evaluate investment projects according to the NPV criterion.
- The next few chapters concern *financing* decisions, such as:
  - How much debt and equity to sell
  - When to sell debt and equity
  - When (or if) to pay dividends
- We can use NPV to evaluate financing decisions.

Creating Value through Financing

1. Fool Investors
   - Empirical evidence suggests that it is hard to fool investors consistently.
2. Reduce Costs or Increase Subsidies
   - Certain forms of financing have tax advantages or carry other subsidies.
3. Create a New Security
   - Sometimes a firm can find a previously-unsatisfied clientele and issue new securities at favorable prices.
   - In the long-run, this value creation is relatively small.

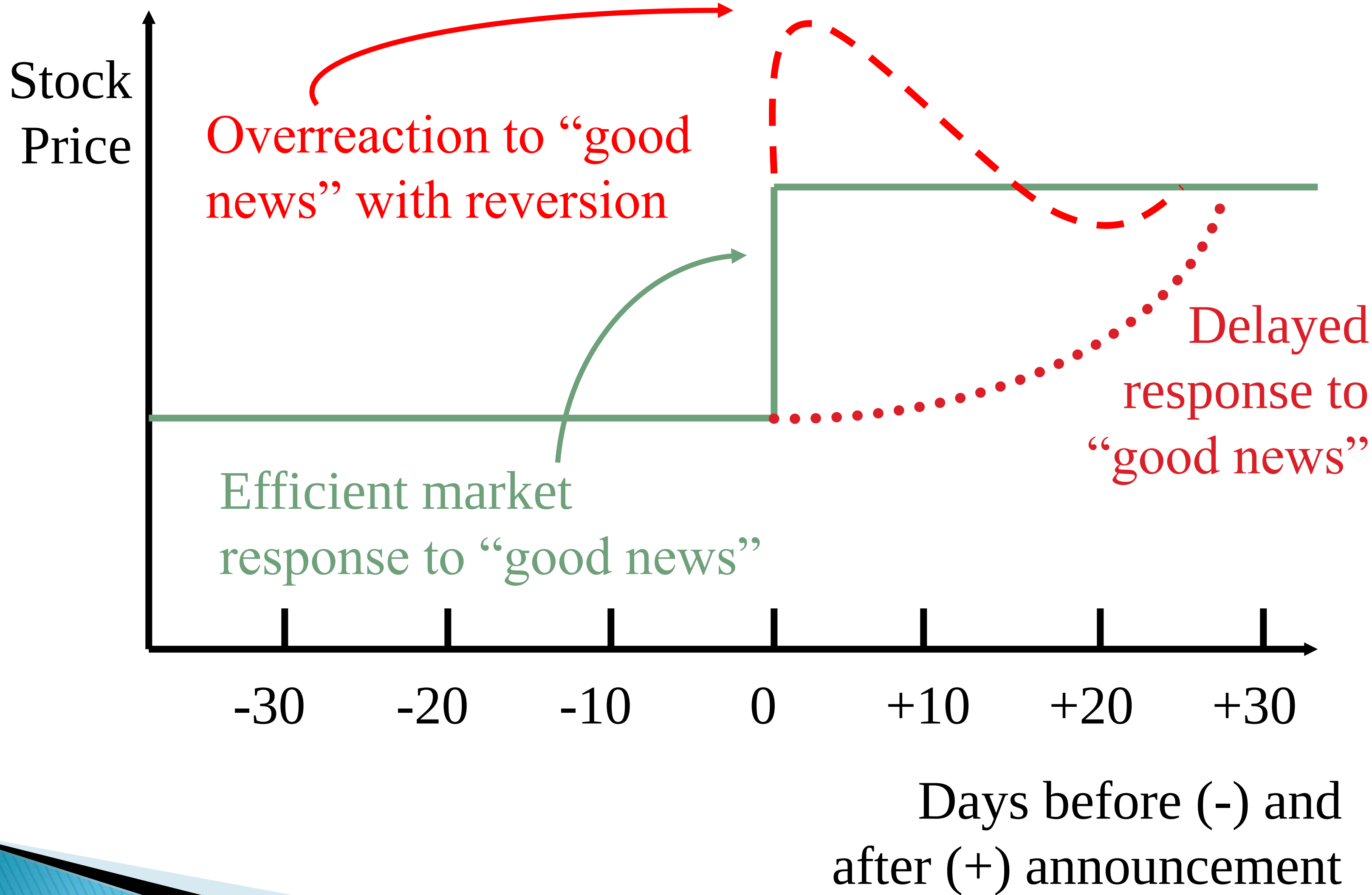
14.2 A Description of Efficient Capital Markets

- An *efficient* capital market is one in which stock prices fully reflect available information.
- The EMH has implications for investors and firms.
  - Since information is reflected in security prices quickly, knowing information *when it is released* does an investor little good.
  - Firms should expect to receive the fair value for securities that they sell. Firms cannot profit from fooling investors in an efficient market.

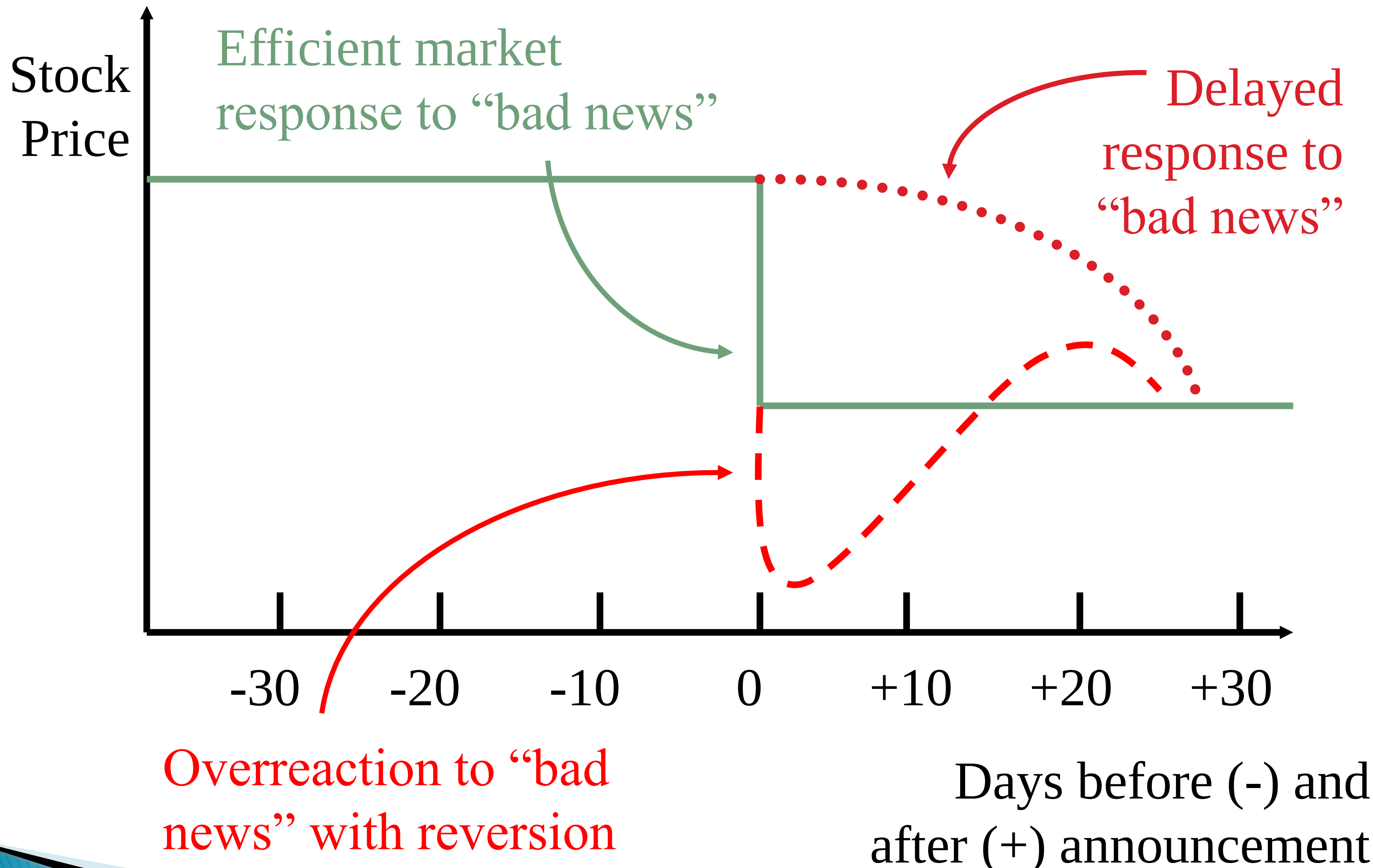
Foundations of Market Efficiency

- Investor Rationality
- Independence of events
- Arbitrage

Stock Price Reactions



Stock Price Reactions



14.3 The Different Types of Efficiency

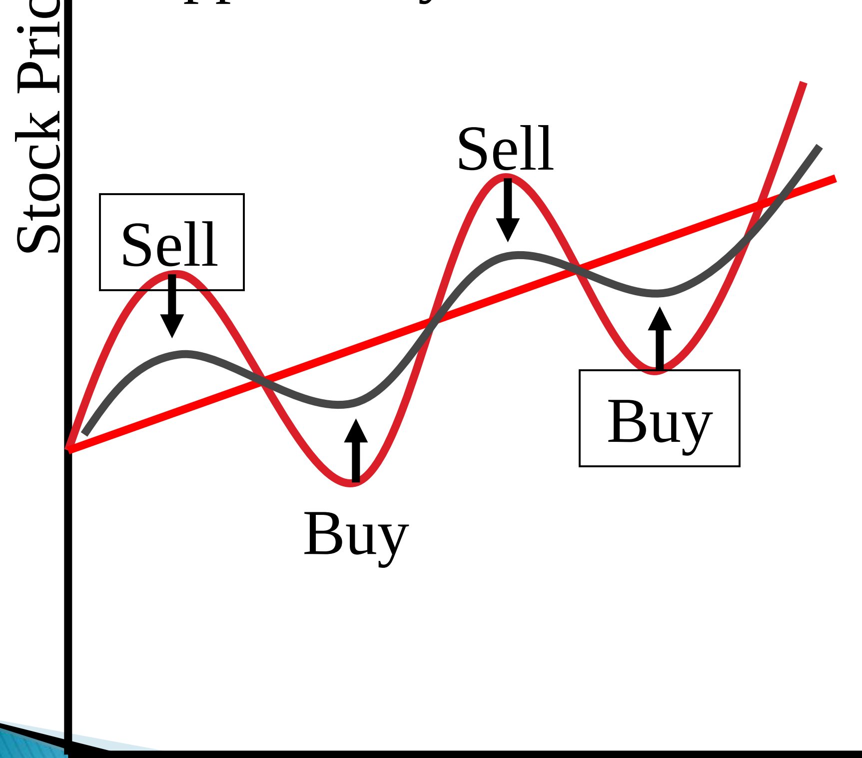
- Weak Form
  - Security prices reflect all historical information
- Semistrong Form
  - Security prices reflect all publicly available information
- Strong Form
  - Security prices reflect all information—public and private

Weak Form Market Efficiency

- Security prices reflect all information found in past prices and volume.
- If the weak form of market efficiency holds, then technical analysis is of no value.
- Since stock prices only respond to *new* information, which by definition arrives randomly, stock prices are said to follow a random walk.

Why Technical Analysis Fails

Investor behavior tends to eliminate any profit opportunity associated with stock price patterns.



If it were possible to make big money simply by finding “the pattern” in the stock price movements, everyone would do it, and the profits would be competed away.

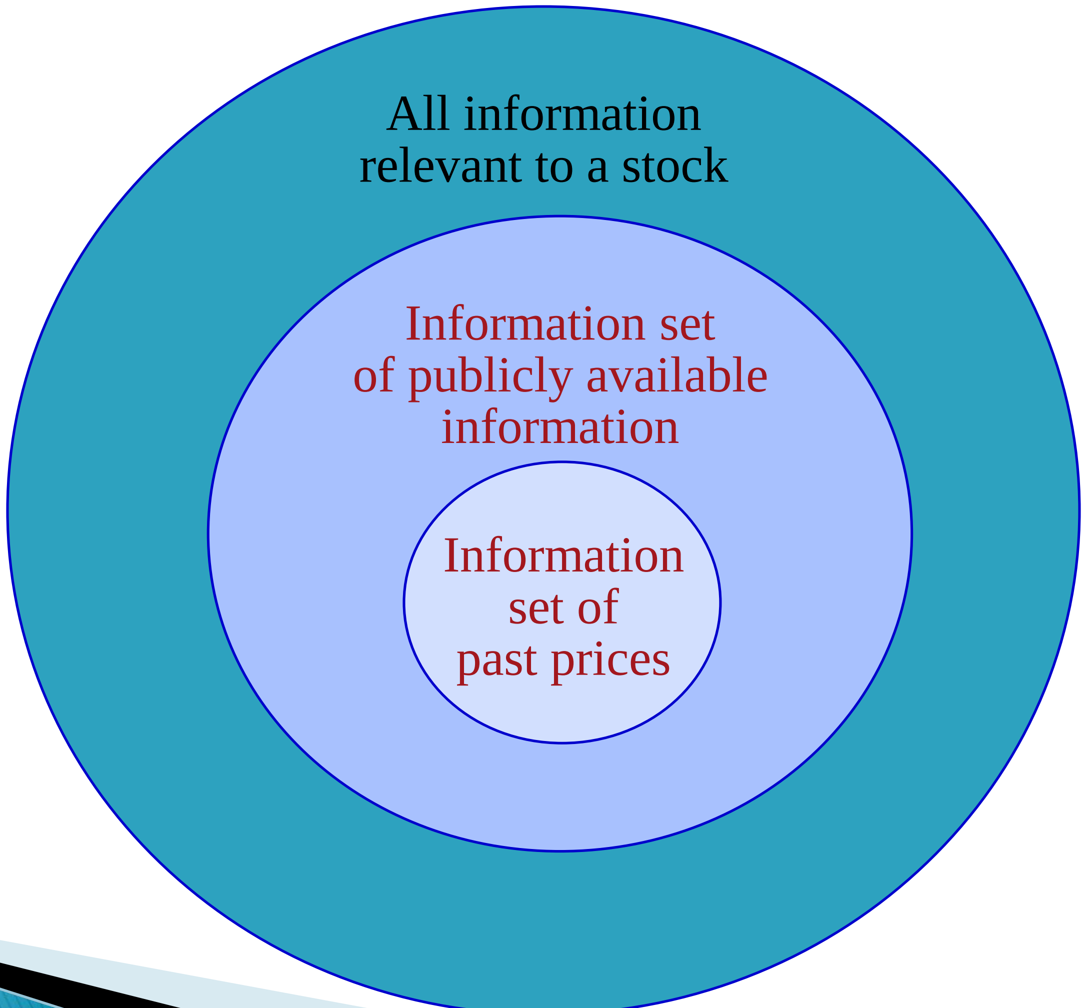
Semistrong Form Market Efficiency

- Security prices reflect all publicly available information.
- Publicly available information includes:
  - Historical price and volume information
  - Published accounting statements
  - Information found in annual reports

Strong Form Market Efficiency

- Security prices reflect all information—public and private.
- Strong form efficiency incorporates weak and semistrong form efficiency.
- Strong form efficiency says that *anything* pertinent to the stock and known to at least one investor is already incorporated into the security's price.

Information Sets



What the EMH Does and Does NOT Say

- Investors can throw darts to select stocks.
  - This is almost, but not quite, true.
  - An investor must still decide how risky a portfolio he wants based on risk aversion and expected return.
- Prices are random or uncaused.
  - Prices reflect information.
  - The price CHANGE is driven by *new* information, which by definition arrives randomly.
  - Therefore, financial managers cannot "time" stock and bond sales.

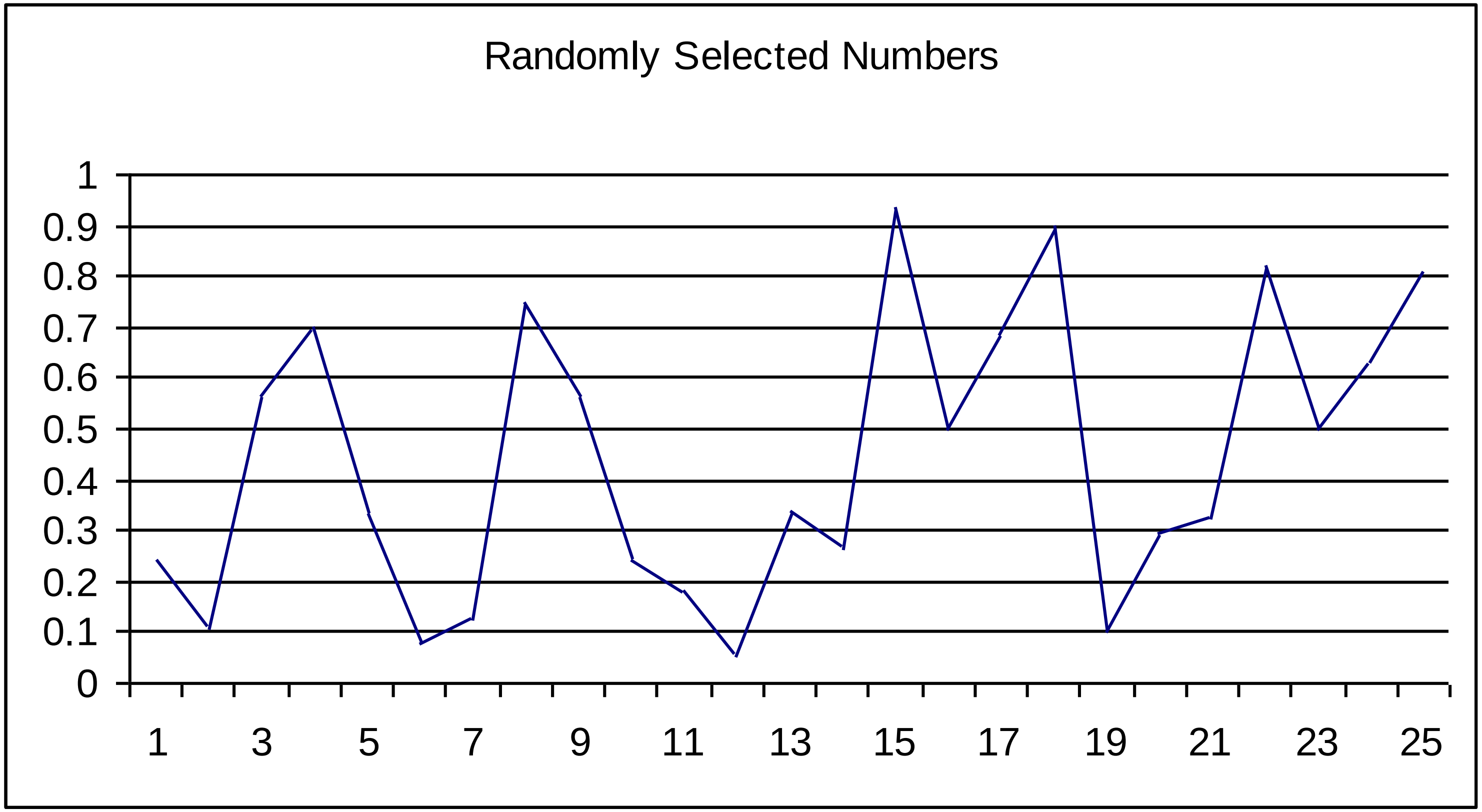
14.4 The Evidence

- The record on the EMH is extensive, and, in large measure, it is reassuring to advocates of the efficiency of markets.
- Studies fall into three broad categories:
  1. Are changes in stock prices random? Are there profitable “trading rules?”
  2. Event studies: does the market quickly and accurately respond to new information?
  3. The record of professionally managed investment firms.

Are Changes in Stock Prices Random?

- Can we really tell?
  - Many psychologists and statisticians believe that most people want to see patterns even when faced with pure randomness.
  - People claiming to see patterns in stock price movements are probably seeing optical illusions.
- A matter of degree
  - Even if we can spot patterns, we need to have returns that beat our transactions costs.
- Random stock price changes support weak form efficiency.

What Pattern Do You See?



Event Studies

- Event Studies are one type of test of the semistrong form of market efficiency.
  - ✓ Recall, this form of the EMH implies that prices should reflect all publicly available information.
- To test this, event studies examine prices and returns over time—particularly around the arrival of new information.
- Test for evidence of underreaction, overreaction, early reaction, or delayed reaction around the event.

Event Studies

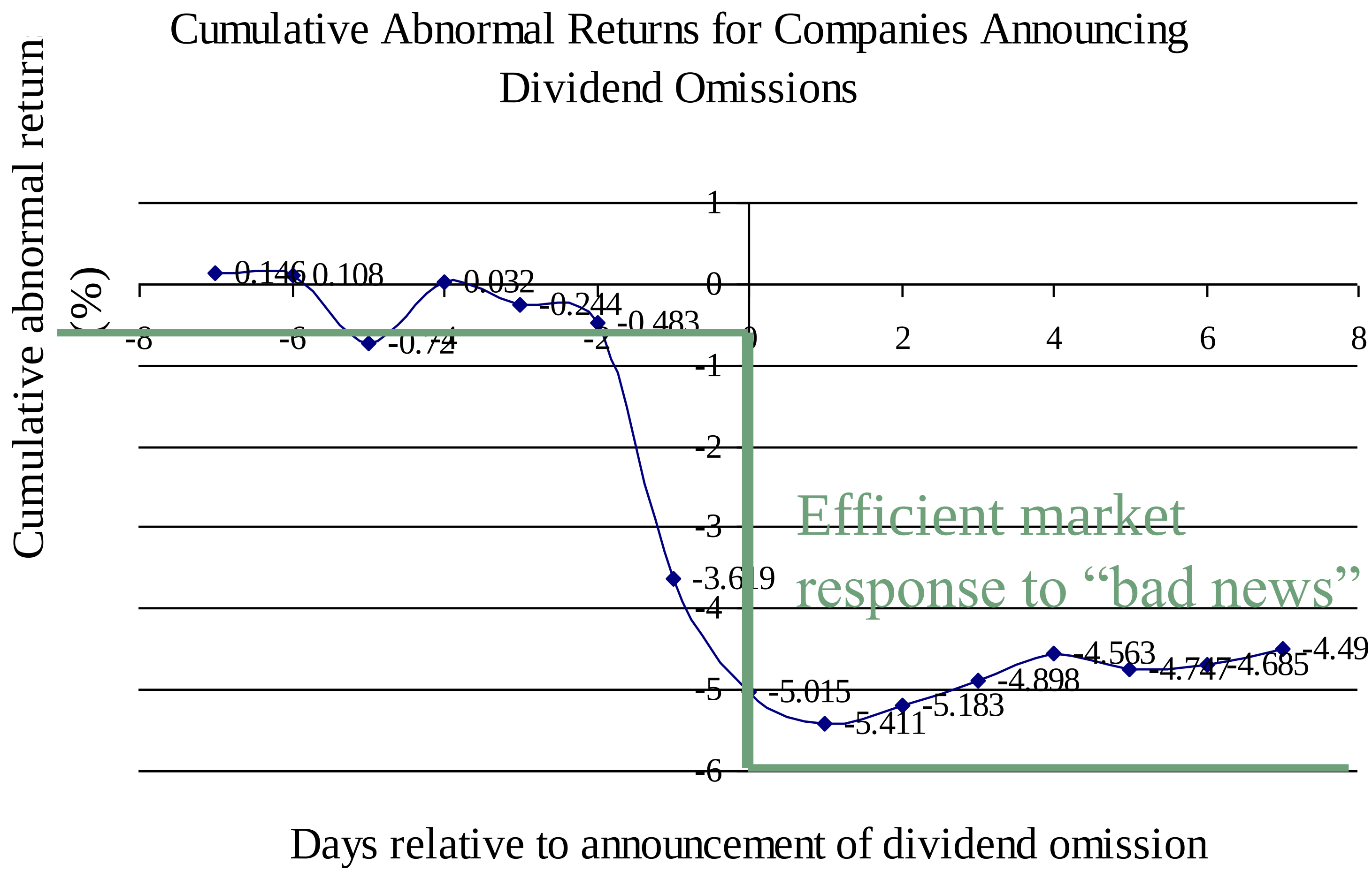
- Returns are adjusted to determine if they are *abnormal* by taking into account what the rest of the market did that day.
- The *Abnormal Return* on a given stock for a particular day can be calculated by subtracting the market's return on the same day (R_M) from the actual return (R) on the stock for that day:

$$AR = R - R_M$$

- The abnormal return can be calculated using the Market Model approach:

$$AR = R - (\alpha + \beta R_M)$$

Event Studies: Dividend Omissions



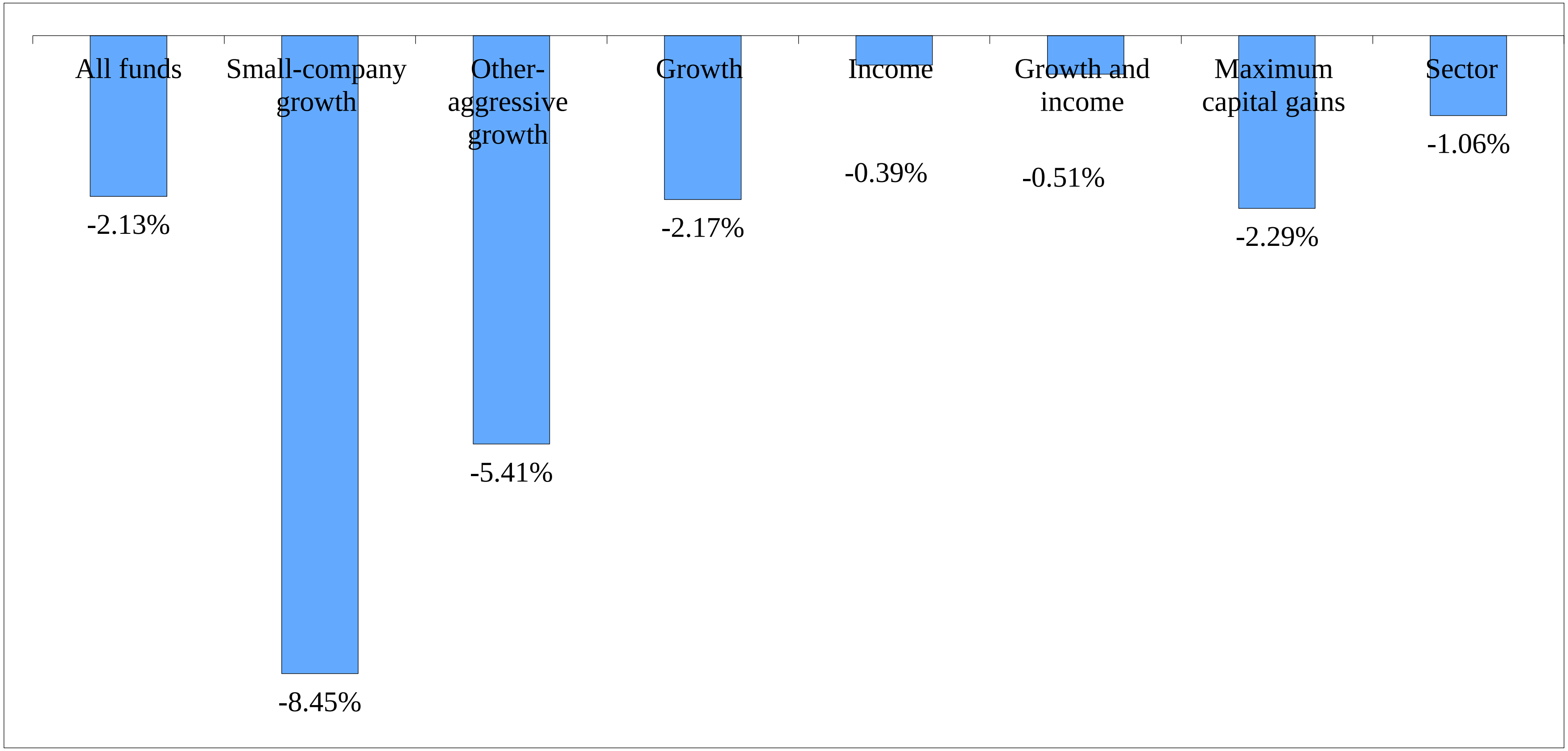
Event Study Results

- Over the years, event study methodology has been applied to a large number of events including:
  - Dividend increases and decreases
  - Earnings announcements
  - Mergers
  - Capital Spending
  - New Issues of Stock
- The studies generally support the view that the market is semistrong form efficient.
- Studies suggest that markets may even have some "foresight" into the future, i.e., news tends to leak out in advance of public announcements.

The Record of Mutual Funds

- If the market is semistrong form efficient, then no matter what publicly available information mutual fund managers rely on to pick stocks, their average returns should be the same as those of the average investor in the market as a whole.
- We can test efficiency by comparing the performance of professionally managed mutual funds with the performance of a market index.

The Record of Mutual Funds



Taken from Lubos Pastor and Robert F. Stambaugh, "Mutual Fund Performance and Seemingly Unrelated Assets," *Journal of Financial Economics,* 63 (2002).

The Strong Form of the EMH

- One group of studies of strong form market efficiency investigates insider trading.
- A number of studies support the view that insider trading is abnormally profitable.
- Thus, strong form efficiency does not seem to be substantiated by the evidence.

14.5 The Behavioral Challenge

- Rationality
  - People are not always rational.
  - Many investors fail to diversify, trade too much, and seem to try to maximize taxes by selling winners and holding losers.

Examples of Behavioral Biases

- Overconfidence
- Disposition effect
  - Seeking pride and avoiding regret
- Familiarity
- Representativeness (overreaction)
- Conservatism (underreaction)
- Risk taking
  - House money and snakebite effects

Independent Deviations from Rationality

- Psychologists argue that people deviate from rationality in predictable ways:
  - Representativeness: drawing conclusions from too little data
    - This can lead to bubbles in security prices.
  - Conservatism: people are too slow in adjusting their beliefs to new information.
    - Security prices seem to respond too slowly to earnings surprises.

Arbitrage

- The Process
  - Suppose that your superior, rational, analysis shows that company ABC is overpriced.
  - Arbitrage would suggest that you should short the shares.
  - After the rest of the investors come to their senses, you make money because you were smart enough to "sell high and buy low."
- But what if the rest of the investment community does not come to their senses in time for you to cover your short position?
  - This makes arbitrage risky.

14.6 Empirical Challenges

- Limits to Arbitrage
  - "Markets can stay irrational longer than you can stay solvent." *John Maynard Keynes*
- Earnings Surprises
  - Stock prices adjust slowly to earnings announcements.
  - Behavioralists claim that investors exhibit *conservatism*.
- Size
  - Small cap stocks seem to outperform large cap stocks.
- Value versus Growth
  - High book-value-to-stock-price stocks and/or high E/P stocks outperform growth stocks.

Empirical Challenges

- Crashes
  - On October 19, 1987, the stock market dropped between 20 and 25 percent on a Monday following a weekend during which little surprising news was released.
  - A drop of this magnitude for no apparent reason is inconsistent with market efficiency.
- Bubbles
  - Consider the tech stock bubble of the late 1990s.

14.7 Reviewing the Differences

- Financial Economists have sorted themselves into three camps:
  1. Market efficiency
  2. Behavioral finance
  3. Those that admit that they do not know
- This is perhaps the most contentious area in the field.

14.8 Implications for Corporate Finance

- If information is reflected in security prices quickly, investors should only expect to obtain a normal rate of return.
  - Awareness of information when it is released does an investor little good. The price adjusts before the investor has time to act on it.
- Firms should expect to receive the fair value for securities that they sell.
  - *Fair* means that the price they receive for the securities they issue is the present value.
  - Thus, valuable financing opportunities that arise from fooling investors are unavailable in efficient markets.

Implications for Corporate Finance

- The EMH has important implications for corporate finance:
  1. The price of a company's stock cannot be affected by a change in accounting.
  2. Financial managers cannot "time" issues of stocks and bonds using publicly available information.
  3. A firm can sell as many shares of stocks or bonds as it desires without depressing prices.
- There is conflicting empirical evidence on all three points.

Why Doesn't Everybody Believe?

- There are optical illusions, mirages, and apparent patterns in charts of stock market returns.
- The truth is less interesting.
- There is some evidence against market efficiency:
  - Seasonality
  - Small versus large stocks
  - Value versus growth stocks
- The tests of market efficiency are weak.

Lecture 9

Long-Term Financing: An Introduction

Entrepreneurial Finance

Features of Common Stock

- Voting rights (Cumulative vs. Straight)
- Proxy voting
- Classes of stock
- Other rights
  - Share proportionally in declared dividends
  - Share proportionally in remaining assets during liquidation
  - Preemptive right – the right to purchase new stock issued, so as to maintain proportional ownership

Features of Preferred Stock

- Dividends
  - Stated dividend must be paid before dividends can be paid to common stockholders.
  - Dividends are not a liability of the firm, and preferred dividends can be deferred indefinitely.
  - Most preferred dividends are cumulative – any missed preferred dividends have to be paid before common dividends can be paid.
- Preferred stock generally does not carry voting rights.

Debt versus Equity

- Debt
  - Not an ownership interest
  - Creditors do not have voting rights
  - Interest is considered a cost of doing business and is tax deductible
  - Creditors have legal recourse if interest or principal payments are missed
  - Excess debt can lead to financial distress and bankruptcy
- Equity
  - Ownership interest
  - Common stockholders vote for the board of directors and other issues
  - Dividends are not considered a cost of doing business and are not tax deductible
  - Dividends are not a liability of the firm, and stockholders have no legal recourse if dividends are not paid
  - An all-equity firm cannot go bankrupt

The Bond Indenture

- Contract between the company and the bondholders that includes:
  - The basic terms of the bonds
  - The total amount of bonds issued
  - A description of property used as security, if applicable
  - Sinking fund provisions
  - Call provisions
  - Details of protective covenants

Bond Classifications

- Registered vs. Bearer Forms
- Security
  - Collateral – secured by financial securities
  - Mortgage – secured by real property, normally land or buildings
  - Debentures – unsecured
  - Notes – unsecured debt with original maturity less than 10 years
- Seniority

Required Yields

- The coupon rate depends on the risk characteristics of the bond when issued.
- Which bonds will have the higher coupon, all else equal?
  - Secured debt versus a debenture
  - Subordinated debenture versus senior debt
  - A bond with a sinking fund versus one without
  - A callable bond versus a non-callable bond

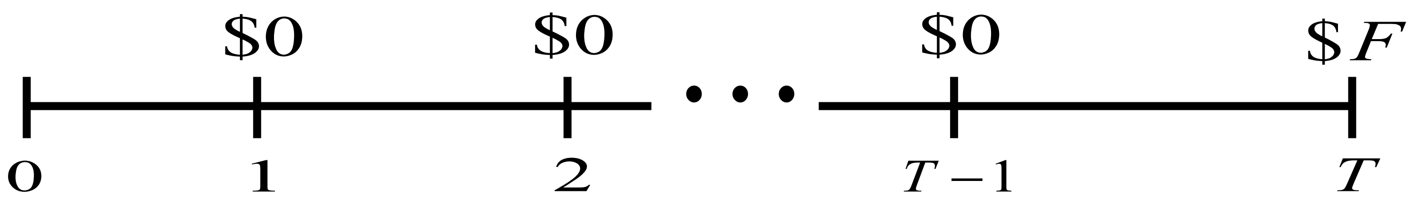
Zero Coupon Bonds

- Make no periodic interest payments (coupon rate = 0%)
- The entire yield to maturity comes from the difference between the purchase price and the par value
- Cannot sell for more than par value
- Sometimes called zeroes, deep discount bonds, or original issue discount bonds (OIDs)
- Treasury Bills and principal-only Treasury strips are good examples of zeroes

Pure Discount Bonds

Information needed for valuing pure discount bonds:

- Time to maturity (T) = Maturity date - today's date
- Face value (F)
- Discount rate (r)



Present value of a pure discount bond at time 0:

$$PV = \frac{F}{(1+r)^T}$$

Floating Rate Bonds

- Coupon rate floats depending on some index value
- Examples – adjustable rate mortgages and inflation-linked Treasuries
- There is less price risk with floating rate bonds.
  - The coupon floats, so it is less likely to differ substantially from the yield to maturity.
- Coupons may have a "collar" – the rate cannot go above a specified "ceiling" or below a specified "floor."

Other Bond Types

- Income bonds
- Convertible bonds
- Put bonds
- There are many other types of provisions that can be added to a bond, and many bonds have several provisions – it is important to recognize how these provisions affect required returns.

15.4 Bank Loans

- Lines of Credit
  - Provide a maximum amount the bank is willing to lend
  - If guaranteed, referred to as a revolving line of credit
- Syndicated Loan
  - Large money-center banks frequently have more demand for loans than they have supply.
  - Small regional banks are often in the opposite situation.
  - As a result, a lager money center bank may arrange a loan with a firm or country and then sell portions of the loan to a syndicate of other banks.
  - A syndicated loan may be publicly traded.

15.5 International Bonds

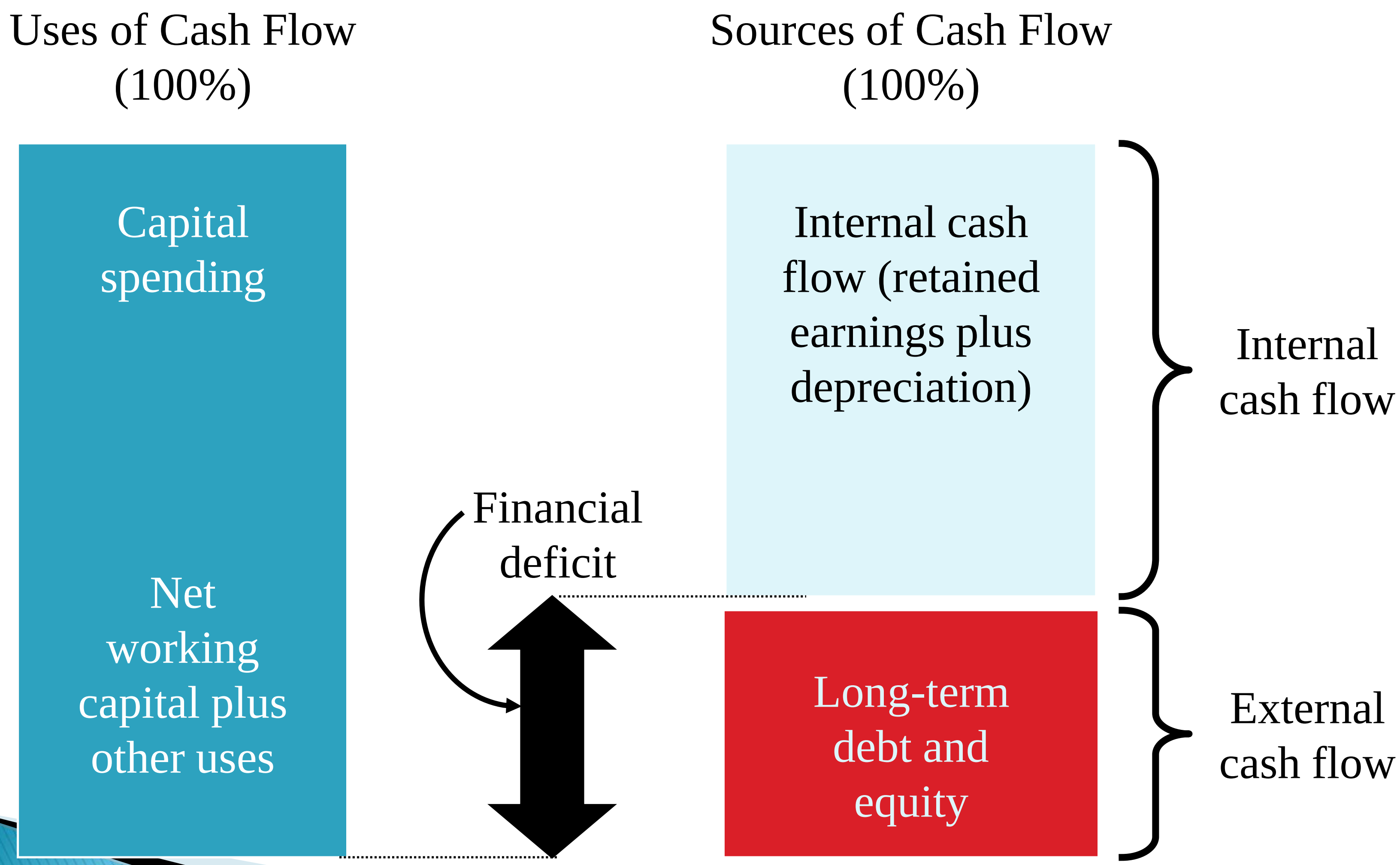
- Eurobonds: bonds denominated in a particular currency and issued simultaneously in the bond markets of several countries

- Foreign bonds: bonds issued in another nation’s capital market by a foreign borrower

15.6 Patterns of Financing

- Internally generated cash flow dominates as a source of financing
  - This preference has increased through time
- Net stock buybacks accelerated in 2002-2007
  - Declined in 2008, likely as a result of the financial crisis

The Long-Term Financial Deficit



15.7 Recent Trends in Capital Structure

- Which are best: book or market values?
  - In general, financial economists prefer market values.
  - However, many corporate treasurers may find book values more appealing due to the volatility of market values.
- Whether we use book or market values, debt ratios for U.S. non-financial firms have been below 50 percent of total financing.

Entrepreneurial Finance

Ravi Thomas
CMU Silicon Valley
Ex-CFO, EngageClick

Entrepreneurial Finance

- Entrepreneurial situations are characterized by two fundamental problems that form the basis for much of Corporate Finance
  - Agency Problems
  - Information Asymmetries
- Entrepreneurial Finance differs in the sense that the magnitude of the problems are worse, requiring contractual solutions that differ from those typically encountered in more established corporations

Contracting Issues

- Information Asymmetries between Investors and Entrepreneurs
  - Difficult for outside investors to ascertain quality and potential value of technological innovation
- Moral Hazard Problem
  - Incentive exists for entrepreneurs to misallocate the funds by spending on items that benefit them disproportionately.

Entrepreneurial Financing Contracts

SHIFT substantial amount of the risk to the entrepreneur.

Type of Security

Allocate Cash flow rights by Convertible Preferred Stock Financing

Senior Liquidation Rights

Conversion Rights

Redemption Rights

Dividends

Covenants

Staged Financing

Right of first refusal (option to invest more)

Anti-Dilution

Board Rights

Non-compete clauses

Facts of Life for Entrepreneurs

- Standard VC contracts reward entrepreneurs for creating companies which go public or are acquired on favorable terms
  - Entrepreneurs on the average earned $9m from each VC backed company
  - Venture Capitalists on the average earned $5m in fee revenue (management fees and 20–25% of the profits of the fund)

Funding Options for Start-Up Companies

Bootstrapping	Equity Financing
Early Sources • Founders Capital •Savings •Credit Cards •Second Mortgage •Venture Leasing •Sales Revenue	**Early Sources** •Friends and Family •Angels •Angel Groups •Early Stage Venture Capital Firms
Later Sources •Credit Lines •SBA loans •Asset Backed Lending •Corporate Partnerships •Banks •Government Grants •Earnings	**Later Sources** •Venture Capital Firms •Corporate Venture Funds •Private Equity Firms •Private Placement Firms •Mezzanine Financing Firms •Investment Banks •Public Markets

Bootstrapping

- For many firms this is the only option available and growth is funded by earnings.

Entrepreneurial Ventures

- Seed Capital Financing
  - Need to form a C-Corporation, clear its name, create its by-laws and other corporate documents.
- This is usually a necessary condition for VC financing and it can often be done without a business plan in hand

23

Venture Capital Funding

- Executive Summary
  - The Problem and the Solution
    - *"Customers must need it right now"*
  - Market Size
    - How big? Answer: > $1B
  - Sales Strategy and Distribution Channels
  - Intellectual Property
  - Competition
    - Never say you do not have any
    - What is your advantage? It has to be "unfair."
  - Management Team
  - Pro-Forma Financials

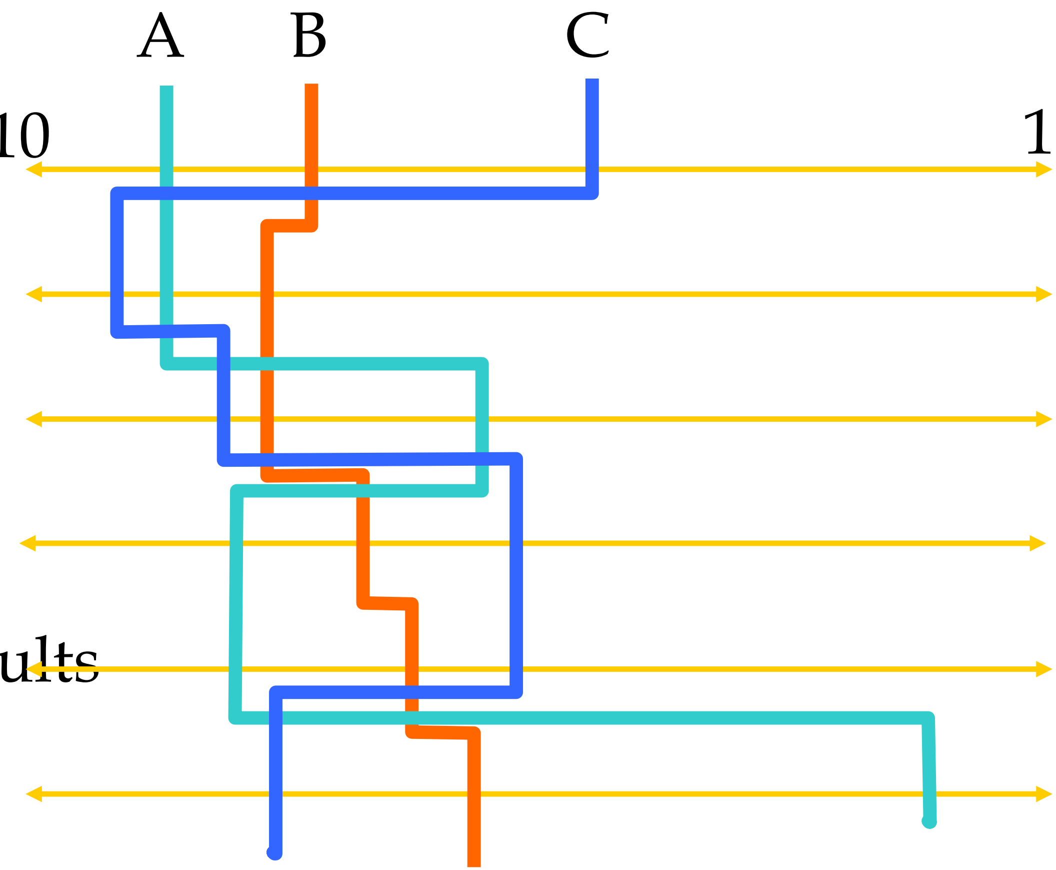
The Deal Scorecard

10 — 1

1. Management
2. Market
3. Competition
4. Product/Technology
5. Ability to Forecast Results
6. Capital Intensity

No Single Recipe

1. Management
2. Market
3. Competition
4. Product/Technology
5. Ability to Forecast Results
6. Capital Intensity



Starting a Corporation

- Why do we need a Corporate Structure?
  - Raise Funds
    - Preferred vs Common Stock
  - Intend to provide Employee Stock Options
- Alternatives?
  - Sole Proprietorship
  - General Partnership
  - Limited Partnership
  - LLC

Corporation

- C versus S Corporation
  - S Corp (pass through taxation)
  - S Corp (no non-resident investors)
  - S Corp -- One type of stock
- Delaware versus California

28

Initial Capital Structure

- Common Stock
  - Founders Stock is common stock
  - Employee Stock is common

29

Private Company Financing–Founder Financing

Very early stage of the Company–usually less than $250K

- Types:
  - Notes (simple Debt)
  - Convertible Notes with discount or warrant coverage in next qualified financing
  - Series A Preferred (DO NOT issue Common Stock)
- Advantages:
  - Founder sets terms
  - Founder can receive vested shares
- Disadvantages
  - Treatment of Debt in next series of financing
  - Overreaching on terms
  - Valuation Issues

Warrants

- A **warrant** is a security that entitles the holder to buy the underlying stock of the issuing company at a fixed price called **exercise price** until the expiry date.
  - Longer dated than an option.

Private Company Financings– Angels / Friends and Family

Generally between $250K to $1.5m

- Types:
  - Convertible Note (with discount or warrant coverage)
    1. Discount of around 10% to 30% in qualified financing
    2. Warrant coverage of around 10% to 30% depending on timing of next financing
       - Formulae: warrants = (coverage % * note) / conversion price
       - Can be capped, and or based on investment amount or length of time note is outstanding
- Series A Preferred Stock
  - Favorable terms but:
    - Valuations Issues
    - Approval rights

Private Company Financing– Early Stage VCs

- $500K to $2m
- Convertible Notes
- Right to lead next qualified financing
- Management rights

- Advantages
  - Quick and Simple
- Disadvantages
  - Limit alternative investors in next financing

THIS TERM SHEET SUMMARIZES THE PRINCIPAL TERMS OF THE PROPOSED FINANCING OF STARTUP, INC. (THE "*COMPANY*"). THIS TERM SHEET IS FOR DISCUSSION PURPOSES ONLY. THERE IS NO OBLIGATION ON THE PART OF ANY NEGOTIATING PARTY UNTIL A DEFINITIVE AGREEMENT IS SIGNED BY ALL PARTIES. THIS TERM SHEET DOES NOT CONSTITUTE EITHER AN OFFER TO SELL OR AN OFFER TO PURCHASE SECURITIES.

Non-Binding Term Sheet

October 27, 2006

Startup, Inc., a Cayman Islands company (the "Company")
Convertible Note Financing

1. **Term of Loan** – 12 months

2. **Minimum Amount of Notes** – Up to $350,000 in convertible notes which may be issued in multiple closings (the "**Notes**"). The Notes will be unsecured.

3. **Interest** – 8%/year, simple interest.

4. **Conversion Features** – Principal and interest due under the Notes automatically converts into preferred stock of the Company of the same series and with the same contract rights as is sold in the Company's next equity financing in which the Company raises at least $1,000,000 (including conversion of Notes) (a "**Qualified Financing**"); *provided* that, if a Qualified Financing does not close prior to the Note maturity date, then the Notes shall no longer convert but rather shall be due and payable. Lenders will receive preferred stock in the Qualified Financing as a result of automatic conversion on the same terms and conditions as other investors except as provided below under Discount.

5. **Prepayment** – Company may prepay the Note and accrued interest at any time prior to a Qualified Financing.

6. **Discount** – Each lender will receive a discount of 20% on the price per share of preferred stock in the Qualified Financing when a Note is converted into preferred stock.

7. **Acquisition** – In the event that the Company is acquired prior to the earlier of the conversion of the Notes in a Qualified Financing or the maturity date, then each noteholder shall be paid an amount equal to 1.5 the principal outstanding under each Note within 30 days after such acquisition.

8. **Subordination** – The Notes shall be subordinated to any Company borrowings from banks or other financial institutions.

9. **Securities** – Each lender must be an "accredited investor" or qualify under another securities law exemption.

FOR EDUCATIONAL PURPOSES ONLY
FRED GREGURAS
FENWICK & WEST LLP
fgreguras@fenwick.com

THIS TERM SHEET SUMMARIZES THE PRINCIPAL TERMS OF THE PROPOSED FINANCING OF STARTUP, INC. (THE "*COMPANY*"). THIS TERM SHEET IS FOR DISCUSSION PURPOSES ONLY. EXCEPT FOR ITEM 16 BELOW, THERE IS NO OBLIGATION ON THE PART OF ANY NEGOTIATING PARTY UNTIL A DEFINITIVE STOCK PURCHASE AGREEMENT IS SIGNED BY ALL PARTIES. THE TRANSACTION CONTEMPLATED BY THIS TERM SHEET IS SUBJECT TO THE SATISFACTORY COMPLETION OF DUE DILIGENCE. THIS TERM SHEET DOES NOT CONSTITUTE EITHER AN OFFER TO SELL OR AN OFFER TO PURCHASE SECURITIES.

**MEMORANDUM OF TERMS FOR OFFERING
OF SERIES A PREFERRED STOCK**

October 27, 2006

VALID FOR ACCEPTANCE UNTIL 5:00 P.M. OCTOBER 30, 2006 PST

This memorandum summarizes the major terms of a private placement of Series A Preferred Stock of **Startup, Inc.** (the "**Company**"), an exempt company formed under the laws of the Cayman Islands. All dollar amounts are U.S. dollars.

Proposed Private Placement

1. **Pre-money Valuation:** $6,000,000
2. **Amount of Investment:** $4,000,000
3. **Investors:**
4. **Type of Security:** Series A Preferred Stock
5. **Number of Preferred Shares:** 4,000,000

The post-financing capitalization of the Company will be as follows on a fully-diluted basis:

	Shares	%
Founders (Common Stock)	4,000,000	40
Stock Option Pool (Common Stock)	2,000,000	20
Series A Investors	4,000,000	40
Total:	**10,000,000**	**100**

**FOR EDUCATIONAL PURPOSES ONLY
FRED GREGURAS
FENWICK & WEST LLP
fgreguras@fenwick.com**

VC Financing
Process and Overview

- Steps
  - Meeting with investors and high level due diligence
  - Decision to invest
  - Term Sheet negotiation (0–2 weeks)
  - Financing Documentation (4–6 weeks)
    - Legal and business due diligence
    - Compliance with securities laws
    - Draft (purchase agreement, articles and voting agreements)
    - Prepare closing
  - Sign and receive funding

Process and Overview (continued) Preferred Stock Model

- Cheap Common Stock for Founders and Employees
- Expensive Preferred stock with additional rights
  - Liquidation and dividend preference
  - Voting (Board rights)
  - Protective provisions (veto rights)
  - Conversion rights/Anti-dilution
  - Redemption
  - Registration
  - Information
  - Participation

Valuation Issues

- Methodology
  - Discounted Cash Flow
  - Multiple of Revenue/Sales
  - Multiple of Earnings
  - Real World
    - Customers
    - Revenues/earnings
    - Product development stage
    - Management
- How much are you raising?

Practice (Mystic Art)

- Suppose you need $2m
- Value of the company is 2/.5 or 2/.6
  - Give up 50% to 60%
- Pre-Money = $2
- Post- Money =$4
- Negotiation matters and other offers matter

Preferred Stock Privileges

- Liquidation Rights
- Conversion Rights
- Redemption Rights
- Dividends
- Protective Provisions

40

What do VC's look for?

- What do they want?
  - 3-5 times on average in 4-6 years
- Therefore expected post-money should be 3-5 times. But every investment they look at should have a potential to be a "home run" and return 10-20 times

Importance of Raising money in stages

- Raising $5 million
  - Versus
- Raising $7 million in two stages

Raising Money in Stages

	Take $5			Round 1 $3		Round 2 $4	
Pre-Money	5			5		16	
+ Investment	5			3		4	
Post-Money	10			8		20	
Investment	5			3		4	
/by Post-Money	10			8		20	
Equals Dilution	50%			38%		20%	
Your Shares	100	50%		100	63%	100	50%
VC Shares –Round1	100	50%		60	38%	60	30%
VC Shares –Round 2						40	20%
Total Shares	200	100%		160	100%	200	100%