Chapters 11&12 -- Capital Budgeting

- Capital budgeting
- Project classifications
- Capital budgeting techniques
- Cash flow estimation
- Risk analysis in capital budgeting
- Optimal capital budget

- Capital budgeting

  Strategic business plan: a long-run plan that outlines in broad terms the firm's basic strategy for the next 5 to 10 years

  Capital budgeting: the process of planning expenditures on assets with cash flows that are expected to extend beyond one year

  - Project classifications

    Replacements:
    Need to continue current operations
    Need to reduce costs

    Expansions:
    Need to expand existing products or markets
    Need to expend into new products or markets

    Others: safety/environmental projects, mergers

- Capital budgeting techniques (Chapter 11)

  (1) Net present value (NPV): present value of future net cash flows, discounted at the cost of capital

  $NPV = \sum_{t=0}^{N} \frac{CF_t}{(1+r)^t}$, where r is the cost of capital, CF_t is the cash flow in time t

  (2) Internal rate of return (IRR): rate of return a project earns (a discount rate that forces a project's NPV to equal zero)

  $$NPV = \sum_{t=0}^{N} \frac{CF_t}{(1+IRR)^t} = 0$$

  Problems associated with IRR:
  Multiple rates of return and unrealistic reinvestment rate assumption

(3) Modified internal rate of return (MIRR): discount rate at which the present value of initial cost is equal to the present value of the terminal value

(4) Payback period: the length of time (years) required for an investment's cash flows to cover its cost

(5) Discounted payback period: the length of time (years) required for an investment's cash flows, discounted at the investment's cost of capital to recover its cost

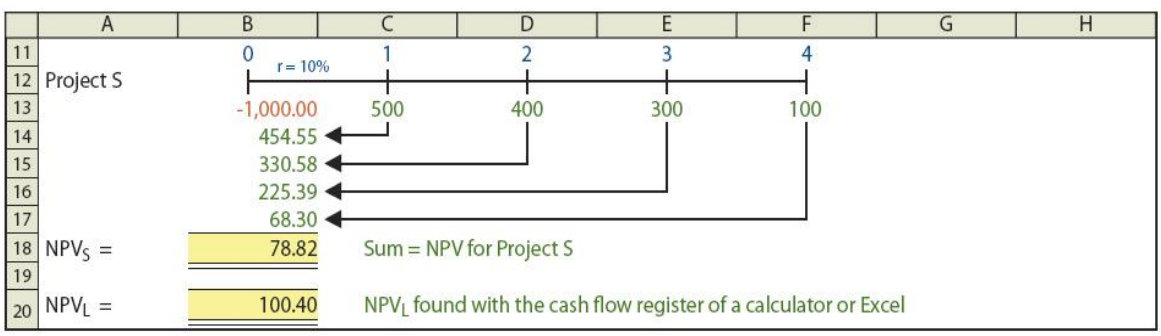
Examples: basic data for projects L and S

Table 11-1 Data on Projects S and L

	A	B	C	D	E	F	G
1							
2							
3	WACC for both projects:		10%				
4							
5		Initial Cost:	After-Tax, End of Year Net Cash Inflows, CF_t:				Total Inflows
6	Years:	0	1	2	3	4	
7	Project S:	-$1,000	$500	$400	$300	$100	$1,300
8	Project L:	-$1,000	$100	$300	$400	$675	$1,475

(1) NPV approach

FIGURE 11-1 Finding the NPV for Projects S and L



TI BAII plus or TI BAII plus professional (CF function)
Press CF first, then press 2nd, followed by pressing CLR WORK
CF_0 = -1,000, enter,↓; $C0_1$ = 500, enter,↓, $F0_1$ = 1,↓; repeat the same procedure to enter $C0_2$ = 400, $C0_3$ = 300, and $C0_4$ = 100; press NPV, you see I = 0.0000; enter 10, press enter and ↓ , you will see NPV = 0.0000; press CPT (on the up left corner); NPV = 78.8198 (keep 4 decimals)

Exercise: check NPV_L = 100.40

Decision rule: if NPV > 0, accept the project; if NPV < 0, reject the project

Independent vs. mutually exclusive projects

Independent projects are projects with cash flows that are not affected by the acceptance or rejection of other projects

Mutually exclusive projects are a set of projects where only one can be accepted

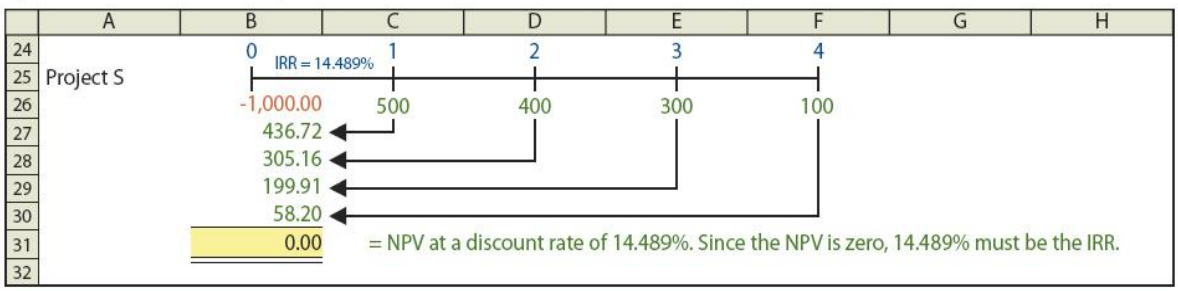
What if L and S are mutually exclusive?
Choose L because $NPV_L > NPV_S$

In general, you should choose the project with the highest positive NPV

If they are independent, you should choose both because NPV for both > 0

(2) IRR approach

FIGURE 11-2 Finding the IRR for Project S



TI BAII plus or TI BAII plus professional (CF function)
Press CF first, then press 2nd, followed by pressing CLR WORK
CF_0 = -1,000, enter,↓; $C0_1$ = 500, enter,↓, $F0_1$ = 1,↓; repeat the same procedure to enter $C0_2$ = 400, $C0_3$ = 300, and $C0_4$ = 100; press IRR, you will see IRR = 0.0000; press CPT (on the up left corner); IRR= 14.4888 (keep 4 decimals)

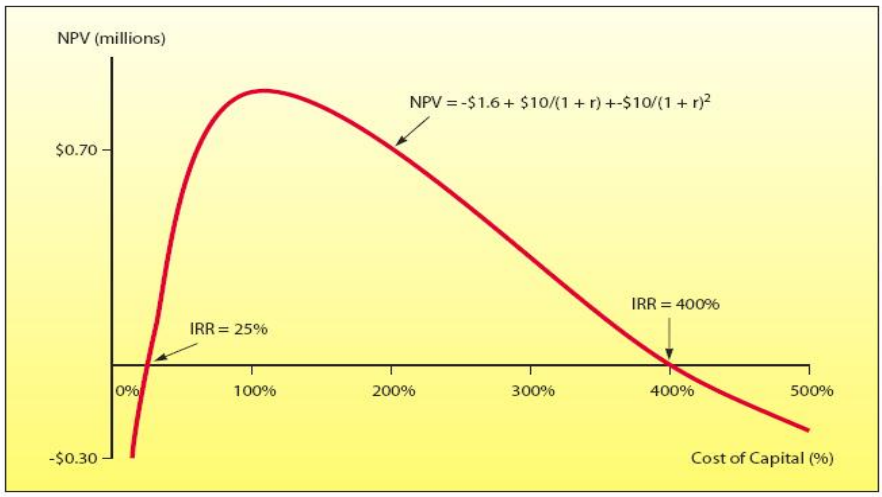
Exercise: check IRR_L = 13.5492%

Decision rule: if IRR > r, accept the project; if IRR < r, reject the project where r is the hurdle rate (the required rate of return for the project)

Multiple IRRs: the situation where a project has two or more solutions (or IRRs)

Reinvestment rate assumptions: NPV approach is based on the assumption that cash flows can be reinvested at the project's risk-adjusted WACC, where the IRR approach is based on the assumption that cash flows can be reinvested at the project's IRR

FIGURE 11-3 Graph for Multiple IRRs: Project M



WACC = 10%

Disc. Rate	NPV (millions)	
10%	-$0.7736	
25%	$0.0000	= IRR #1
110%	$0.8943	
400%	$0.0000	= IRR #2
500%	-$0.2111	

(3) MIRR approach

FIGURE 11-4 Finding the MIRR for Projects S and L, WACC = 10%

WACC = 10%

Project S (r = 10%)

0	1	2	3	4
−$1,000.00	$500	$400	$300	$100.00
				$330.00
				$484.00
				$665.50
−$1,000.00			Terminal Value (TV) =	$1,579.50

$1,000 = TV/(1+MIRR)^N = $1,579.50/(1+MIRR)^4. Solve for MIRR with calculator or Excel.

Calculator: N = 4, PV = −1000, PMT = 0, FV = 1579.5. Press I/YR to get: 12.11%

Excel: = RATE(F70,0,B71,F75) Rate = MIRR 12.11%

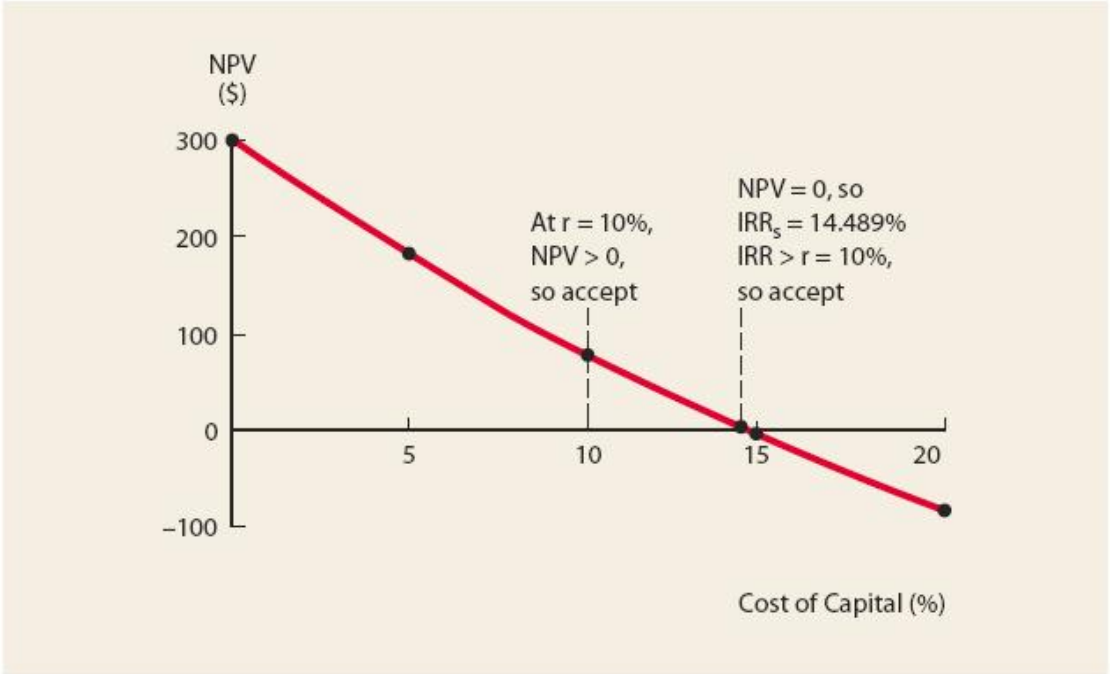
Direct Excel calculation, MIRR function: =MIRR(B71:F71,F69,F69) 12.11%

(1) Compound each future cash inflow to the "terminal year", using WACC
(2) Add all the future values to get "terminal value
(3) Calculate I/YR to get MIRR

Decision rule: if MIRR > r, accept the project; if MIRR < r, reject the project where r is the hurdle rate (the required rate of return for the project)

NPV profile: a graph that shows the relationship between a project's NPV and the firm's cost of capital

FIGURE 11-5 NPV Profile for Project S



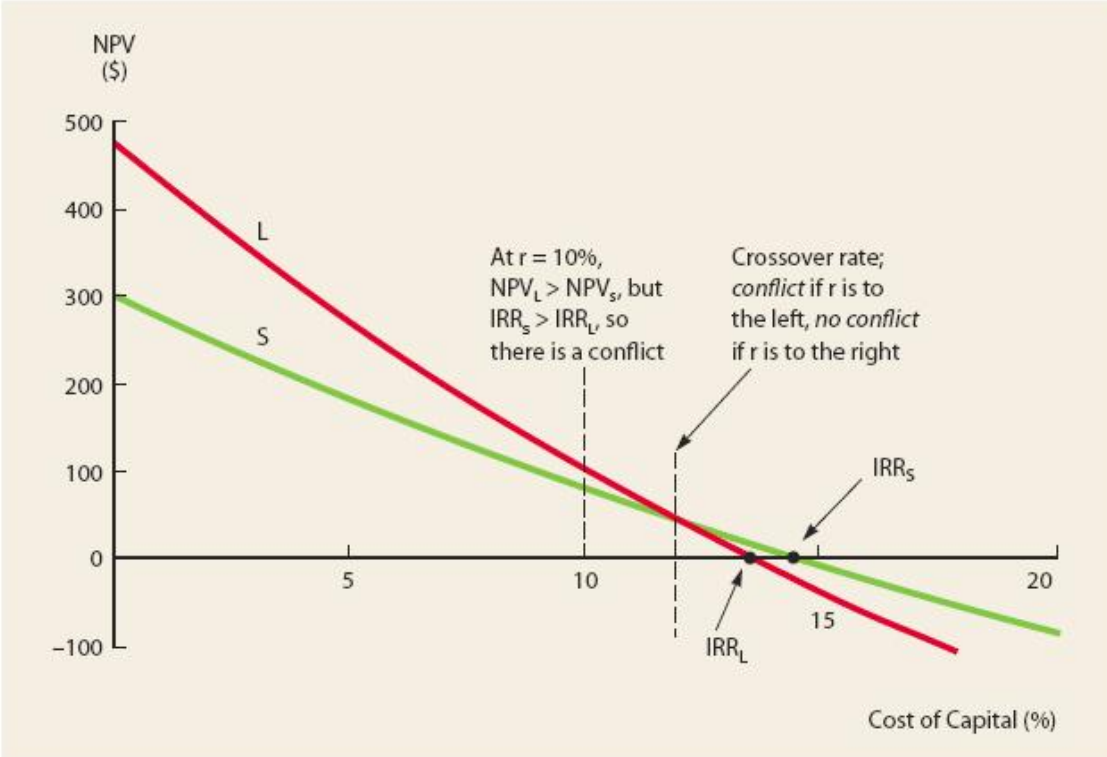
	Cost of Capital	NPV_s
	0%	$300.00
	5	180.00
	10	78.82
IRR_s =	14.489	0.00
	15	−8.33
	20	−83.72

When r < 14.4888%, NPV for S is positive, which means that the project will be accepted

When r > 14.4888%, NPV for S is negative, which means that the project will be rejected

NPV profiles for project L and S

FIGURE 11-6 NPV Profiles for Projects S and L



	Cost of Capital	NPV$_S$	NPV$_L$
	0%	$300.00	$475.00
	5	180.42	268.21
	10	78.82	100.40
Crossover =	11.975	42.84	42.84
IRR$_L$ =	13.549	15.64	0.00
IRR$_S$ =	14.489	0.00	−24.37
	15	−8.33	−37.26
	20	−83.72	−151.33

Crossover rate: the cost of capital at which the NPV profiles of two projects cross and thus, at which the projects' NPVs are equal

How can you calculate the crossover rate (11.9748%)?

If the cost of capital is less than 11.9748%, L is a better project.
If the cost of capital is greater than 11.9748% (but less than 14.4888%), S is a better project.

Ranking problem (conflict): NPV approach and IRR approach sometimes will lead to different rankings for mutually exclusive projects

For example, using NPV approach, project L is better than project S if the cost of capital is 10% (L has a higher NPV than S). Other the other hand, using IRR approach, S is better than L (S has a higher IRR than L)

If ranking problem occurs use NPV approach to make the final decision

Main conditions to cause conflicts
a. Timing of cash flows
b. Scale of cash flows

(4) Payback period approach

FIGURE 11-7 Payback Calculations

Project S	Years	0	1	2	3	4
	Cash flow	−1,000	500	400	300	100
	Cumulative cash flow	−1,000	−500	−100	200	300

Payback S = 2 + 100/300 = 2.33

Project L	Years	0	1	2	3	4
	Cash flow	−1,000	100	300	400	675
	Cumulative cash flow	−1,000	−900	−600	−200	475

Payback L = 3 + 200/675 = 3.30

$$\text{Payback} = \#\text{ of years prior to full recovery} + \frac{\text{unrecovered cost}}{\text{cash flow in full recovery year}}$$

Decision rule:
If payback < maximum payback, then accept the project
If payback > maximum payback, then reject the project

Weaknesses:
Arbitrary maximum payback
Ignores time value of money
Ignores cash flows after maximum payback period

(5) Discounted payback period approach

FIGURE 11-8 Discounted Payback Calculations at 10% Cost of Capital

Project S

Years	0	1	2	3	4
Cash flow	−1,000	500	400	300	100
Discounted cash flow	−1,000	455	331	225	68
Cumulative discounted CF	−1,000	−545	−215	11	79

Discounted payback S = 2 + 215/225 = 2.95

Project L

Years	0	1	2	3	4
Cash flow	−1,000	100	300	400	675
Discounted cash flow	−1,000	91	248	301	461
Cumulative discounted CF	−1,000	−909	−661	−361	100

Discounted payback L = 3 + 361/461 = 3.78

Step 1: discount future cash flows to the present at the cost of capital (round to the nearest whole dollar)
Step 2: follow the steps similar to payback period approach

Decision rule: similar to that of payback period

Weaknesses:
Arbitrary maximum discounted payback period
Ignores cash flows after maximum discounted payback period

Decision criteria used in practice

Table 11-2 Capital Budgeting Methods Used in Practice

	PRIMARY CRITERION			CALCULATE AND USE
	1960	1970	1980	1999
NPV	0%	0%	15%	75%
IRR	20	60	65	76
Payback	35	15	5	57
Discounted Payback	NA	NA	NA	29
Other	45	25	15	NA
Totals	100%	100%	100%	

Sources: The 1999 data are from John R. Graham and Campbell R. Harvey, "The Theory and Practice of Corporate Finance: Evidence from the Field," *Journal of Financial Economics,* 2001, pp. 187–244. Data from prior years are our estimates based on averaging data from these studies: J. S. Moore and A. K. Reichert, "An Analysis of the Financial Management Techniques Currently Employed by Large U.S. Corporations," *Journal of Business Finance and Accounting,* Winter 1983, pp. 623–645; and M. T. Stanley and S. R. Block, "A Survey of Multinational Capital Budgeting," *The Financial Review,* March 1984, pp. 36–51.

- Cash flow estimation (Chapter 12)

  Guidelines when estimating cash flows:
  Use after tax cash flows
  Use increment cash flows
  Changes in net working capital should be considered
  Sunk costs should not be included
  Opportunity costs should be considered
  Externalities should be considered
  Ignore interest payments (separate financing decisions from investment decisions)

  FCF = [EBIT*(1 - T) + depreciation] – [capital expenditures + ΔNOWK)

  EBIT*(1 - T) = net operating profit after tax = NOPAT
  ΔNOWK = change in net operating working capital

  Steps in estimating cash flows:
  (1) Initial outlay
  (2) Differential (operating) cash flows over project's life
  (3) Terminal cash flows
  (4) Time line and solve

  Example: an expansion project

  - Allied is considering purchasing an equipment. The cost is $900,000 (t = 0). The inventory will increase by $175,000 and account payable will increase by $75,000 (the net change in operating working capital will be $100,000).
  - The project will last for 4 years. Allied forecasts of sales of 537,000 units in year 1 (t =1), 520,000 units in year 2 (t = 2), 505,000 units in year 3 (t = 3), and 490,000 in year 4 (t = 4). The unit price is $10.
  - The fixed cost is $2,000,000 each year and the variable cost to product each unit is $5.092 for year 1 (t =1), $5.391 for year 2 (t =2), $5.228 for year 3 (t = 3), and $6.106 for year 4 (t = 4).
  - Allied will use MACRS and straight line depreciation methods to compare the results
  - After 4 years, Allied expects a salvage value of the equipment to be $50,000. The company expects to fully recover the NOWC of $100,000
  - The tax rate for the firm is 40%
  - The project's WACC is estimated to be 10%

  Question: Should Allied take the project?

Table 12-1 **Cash Flow Estimation and Analysis for Expansion Project S**

	A	B	C	D	E	F	G	H	I
1									
2					0	1	2	3	4
3	*Investment Outlays at Time = 0*								
4	Equipment				-$900				
5	Net WC				-100				
6	*Net Cash Flows Over the Project's Life*								
7	Unit sales					537	520	505	490
8	Sales price					$10.00	$10.00	$10.00	$10.00
9	Variable cost per unit					$5.092	$5.391	$5.228	$6.106
10	Sales revenues = Units × Price					$5,370	$5,200	$5,050	$4,900
11	Variable costs = Units × Cost/unit					2,735	2,803	2,640	2,992
12	Fixed operating costs except depr'n					2,000	2,000	2,000	2,000
13	Depreciation: Accelerated from table below					297	405	135	63
14	Total operating costs					$5,032	$5,208	$4,775	$5,055
15	EBIT (or operating income)					$338	-$8	$275	-$155
16	Taxes on operating income		40%			135	-3	110	-62
17	After-tax project operating income					$203	-$5	$165	-$93
18	Add back depreciation					297	405	135	63
19	Salvage value (taxed as ordinary income)								50
20	Tax on salvage value (SV is taxed at 40%)								-20
21	Recovery of net working capital								100
22	Project net cash flows (Time Line)				-$1,000	$500	$400	$300	$100
23	*Depreciation*			Accelerated		1	2	3	4
24		Cost:	$900	Rate		33%	45%	15%	7%
25				Depreciation		$297	$405	$135	$63
26	Alternative *depreciation*			Straight line					
27		Cost:	$900	Rate		25%	25%	25%	25%
28				Depreciation		$225	$225	$225	$225
29	*Project Evaluation @ WACC =*			*10%*					

30		Accelerated	Formulas	Straight line
31	NPV	$78.82	=NPV(D29,F22:I22)+E22	$64.44
32	IRR	14.489%	=IRR(E22:I22)	13.437%
33	MIRR	12.106%	=MIRR(E22:I22,D29,D29)	11.731%
34	Payback	2.33	=G2+(-E22-F22-G22)/H22	2.60

35 1. Accelerated depreciation rates are set by Congress. We show the approximate rates for a 4-year asset in 2008. Companies also have the option of using straight-line depreciation. Under IRS rules, salvage value is not deducted when establishing the depreciable basis. However, if a salvage payment is received, it is called a recapture of depreciation and is taxed at the 40% rate.

36 2. If the firm owned assets that would be used for the project but would be sold if the project is not accepted, the after-tax value of those assets would be shown as an "opportunity cost" in the "Investment Outlays" section.

37 3. If this project would reduce sales and cash flows from one of the firm's other divisions, then the after-tax cannibalization effect, or "externality," would be deducted from the net cash flows shown on Row 22.

38 4. If the firm had previously incurred costs associated with this project, but those costs could not be recovered regardless of whether this project is accepted, then they are "sunk costs" and should not enter the analysis.

Since NPV is positive, Allied should take the project.

Allied should use MACRS to depreciate the new equipment since NPV for the project will be higher.

Cash flow estimation: a new project

The president of Real Time, Inc. has asked you to evaluate the proposed acquisition of a new computer. The computer's price is $40,000 and there will be another $2,000 for shipping and installation. The computer falls into MACRS 3-year class (Use 33%, 45%, 15%, 7% depreciation schedule). Purchase of the computer would require an increase in net working capital of $2,000. The computer would increase the firm's before-tax revenues by $20,000 per year but would also increase operating costs by $5,000 per year. The computer is expected to be used for 3 years and then be sold for $15,000. The firm's marginal tax rate is 40%, and the project's cost of capital is 14%.

a) What is the net initial outlay (at time t = 0)?
b) What are the operating cash flows over 3 years?
c) What is the terminal value (not including the operating cash flow in year 3)?
d) Should the firm purchase the new computer?

Answer:
a) CF_0 = 40,000 + 2,000 + 2,000 = $44,000
b) CF_1 = (20,000 - 5,000) * (1 - 0.40) + 42,000 * 0.33 * 0.4 = $14,544
CF_2 = $16,560
CF_3 = $11,520
c) TCF_3 =15,000 - (15,000 - 42,000*0.07)*0.4 + 2,000 = $12,176
Total cash flow in year 3 = 11520 + 12,176 = $23,696
d) NPV = - $2,505.60 < 0, IRR = 10.84% < 14%

Since NPV < 0, do not take the project.

Example: a replacement project

- Data for both old and new machines
  Sale revenue: $2,500
  Expected life of the old and new machines: 4 years
  WACC: 10%
  Tax: 40%
- Data for old machine
  Salvage value today: $400
  Old labor, materials, and other costs per year: $1,000
  Old machine depreciation: $100 (straight-line method)
- Data for new machine
  Cost of new machine: $2,000 (MACRS depreciation, 33%, 45%, 15% and 7%)
  New labor, materials, and other costs per year: $400

Question: Should the firm buy the new machine to replace the old machine?

Table 12-2 Replacement Project R

	A	B	C	D	E	F	G	H	I
1					0	1	2	3	4
2	*Part I. Net Cash Flows Before Replacement*								
3	Sales revenues					$2,500	$2,500	$2,500	$2,500
4	Costs except depreciation					1,000	1,000	1,000	1,000
5	Depreciation					100	100	100	100
6	Total operating costs					$1,100	$1,100	$1,100	$1,100
7	Operating income					$1,400	$1,400	$1,400	$1,400
8	Taxes 40%					560	560	560	560
9	After-tax operating income					$840	$840	$840	$840
10	Add back depreciation					100	100	100	100
11	Net cash flows before replacement					$940	$940	$940	$940
12	*Part II. Net Cash Flows After Replacement*								
13	New machine cost				-$2,000				
14	After-tax salvage value, old machine				$400				
15	Sales revenues					$2,500	$2,500	$2,500	$2,500
16	Costs except depreciation					400	400	400	400
17	Depreciation					660	900	300	140
18	Total operating costs					$1,060	$1,300	$700	$540
19	Operating income					$1,440	$1,200	$1,800	$1,960
20	Taxes 40%					576	480	720	784
21	After-tax operating income					$864	$720	$1,080	$1,176
22	Add back depreciation					660	900	300	140
23	Net cash flows after replacement				-$1,600	$1,524	$1,620	$1,380	$1,316
24	Part III. Incremental Cash Flows and Evaluation								
25	*Incremental CFs = CF After - CF Before*				-$1,600	$584	$680	$440	$376
26									
27	*Project Evaluation @ WACC = 10%*								
28	NPV =				$80.28				
29	IRR =				12.51%				
30	*MIRR =*				11.35%				
31	*Payback =*				2.76				
32	*Part IV. Alternative (Streamlined) Calculation for NCF*								
33	New machine cost				-$2,000				
34	Salvage value, old machine				400				
35	Net cost of new machine				-$1,600				
36	Cost savings = Old - New					$600	$600	$600	$600
37	A-T savings = Cost savings × (1 - Tax rate)					360	360	360	360
38	Δ Depreciation = (New - old)					560	800	200	40
39	Depr'n tax savings = Δ Depreciation × Tax rate					224	320	80	16
40	NCF = A-T cost savings + Depr'n tax savings				-$1,600	$584	$680	$440	$376

Since NPV for the project is positive, the firm should take the replacement project.

- Risk analysis in capital budgeting

  Adjusting the cost of capital for risk

  Project stand-alone risk: the risk of a project as if it were the firm's only project

  Project's within-firm risk: the amount of risk that a project contributes to the firm

Project's market risk: the risk that a project contributes to the market, measured by the project's beta coefficient

Pure play method to estimate a new project's market risk

Identify firms producing only one product that is the same as your project is going to produce and estimate betas for these firms; average these betas to proxy for your project's beta: use CAPM to estimate your project's required rate of return

Methods to incorporate risk into capital budgeting

Risk-adjusted cost of capital: use the beta risk to estimate the required rate of return for the project and use that rate as the discount rate to evaluate the project; the higher the risk, the higher the discount rate

- Optimal capital budget

  The annual investment in long-term assets that maximizes the firm's value

  Capital rationing: the situation in which a firm can raise a specified, limited amount of capital regardless of how many good projects it has

  For example, a firm has $5 million of capital budget and has three good projects

Project	Initial investment	NPV
A	$5,000,000	$1,000,000
B	$3,000,000	$600,000
C	$2,000,000	$500,000

  The firm should choose projects B and C to maximize firm's value

- **Exercise**

  Chapter 11
  ST-1 and ST-2
  Problems: 7 and 12
  Chapter 12
  ST-1 and ST-2
  Problems: 2, 7, and 9

Chapter 13 -- Capital Structure and Leverage

- Capital structure
- Business risk vs. financial risk
- Break-even analysis
- Determining the optimal capital structure
- Capital structure theories

- Capital structure

  The mix of debt, preferred stock, and common equity that is used by a firm to finance its assets

  The optimal capital structure: the capital structure that maximizes the company's stock price (or minimizes the company's overall cost of capital, WACC)

  Capital structure changes over time

- Business risk vs. financial risk

  Business risk: the riskiness inherent in the firm's operations if it uses no debt
  It is measured by the variability of expected ROE (ROA)

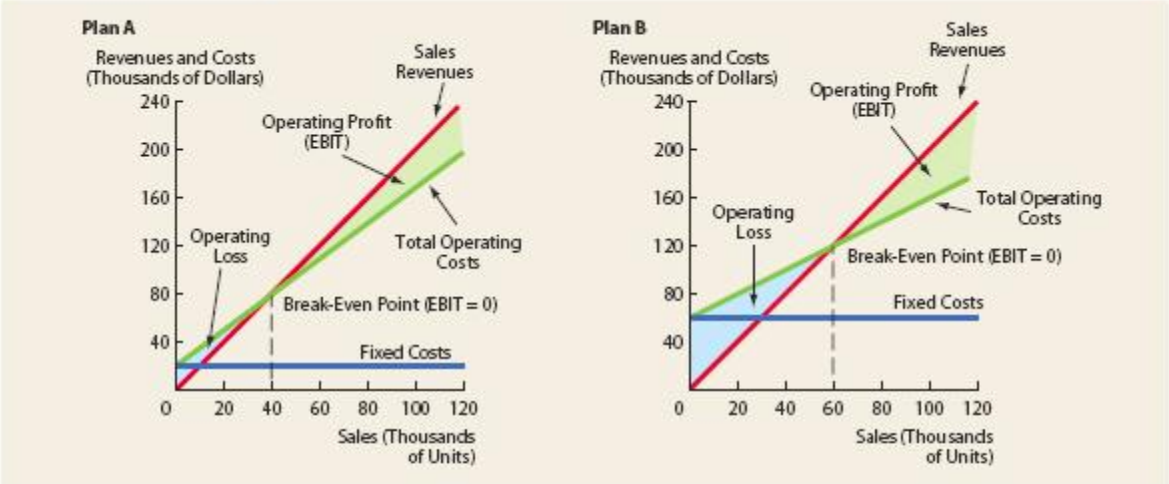
  Business risk depends on:
  Competition
  Demand variability
  Sales price variability
  Input cost variability
  Ability to develop new products
  Operating leverage
  Foreign risk
  Regulations

  Operating leverage: the extent to which the fixed costs are used, the higher the fixed costs, the higher the operating leverage, the higher the business risk

  Financial risk: the additional risk placed on stockholders as a result of the firm's decision to use debt

  Financial leverage: the extend to which fixed income securities are used

FIGURE 13-2 Illustration of Operating Leverage



	Plan A	Plan B
Price	$ 2.00	$ 2.00
Variable costs	$ 1.50	$ 1.00
Fixed costs	$ 20,000	$ 60,000
Assets	$200,000	$200,000
Tax rate	40%	40%

				PLAN A				PLAN B			
Demand	Probability	Units Sold	Dollar Sales	Operating Costs	Operating Profits (EBIT)	Net Income	ROE	Operating Costs	Operating Profits (EBIT)	Net Income	ROE
Terrible	0.05	0	$ 0	$ 20,000	($20,000)	($12,000)	(6.00)%	$ 60,000	($ 60,000)	($36,000)	(18.00)%
Poor	0.20	40,000	80,000	80,000	0	0	0.00	100,000	(20,000)	(12,000)	(6.00)
Normal	0.50	100,000	200,000	170,000	30,000	18,000	9.00	160,000	40,000	24,000	12.00
Good	0.20	160,000	320,000	260,000	60,000	36,000	18.00	220,000	100,000	60,000	30.00
Wonderful	0.05	200,000	400,000	320,000	80,000	48,000	24.00	260,000	140,000	84,000	42.00
Expected value		100,000	$200,000	$170,000	$30,000	$18,000	9.00%	$160,000	$ 40,000	$24,000	12.00%
Standard deviation					$24,698		7.41%		$ 49,396		14.82%
Coefficient of variation					0.82		0.82		1.23		1.23

Notes:
a. Operating costs = Variable costs + Fixed costs.
b. The federal-plus-state tax rate is 40%, so NI = EBIT(1 − Tax rate) = EBIT(0.6).
c. ROE = NI/Equity. The firm has no debt, so Assets = Equity = $200,000.
d. The break-even sales level for Plan B is not shown in the table, but it is 60,000 units or $120,000.
e. The expected values, standard deviations, and coefficients of variation were found using procedures discussed in Chapter 8.

- Break-even analysis

  Variable costs: vary with the output
  Fixed costs: not vary with the output

  Notation: V: variable cost per unit
  Q: the number of units sold
  P: price
  F: fixed costs

  Break-even level of sales: $Q_{BE} = \frac{F}{P - V}$

  Example: F = \$100,000; V = \$6; P = \$10
  Q_{BE} = 25,000 units; $P*Q_B$ = \$250,000 (break-even sales)

- Determining the optimal capital structure

  WACC and capital structure change

  WACC = $w_d(r_d)(1-T) + w_c(r_s)$, assuming no preferred stock
  $= (D/A)*(r_d)*(1-T) + (E/A)*(r_s)$

  where D/A is the debt-to-asset ratio (also called debt ratio) and E/A is the equity-to-asset ratio (also called equity ratio) and D/A + E/A = 1

  You are going to choose D/A or E/A to minimize WACC

  Cost of debt increases with debt; cost of equity increases with debt; beta increases with debt (since higher debt increases the risk of bankruptcy)

  Hamada equation: $b_L = b_U[1+(1-T)(D/E)]$ or $b_U = b_L/[1+(1-T)(D/E)]$

  We observe b_l, T, D/E ratio, therefore we can figure out b_U. We then vary D/E to figure out b_l at different capital structure. We apply CAPM to find the required rates of return and stock prices at different capital structure to find the optimal capital structure that maximizes the stock price (or minimizes the WACC)

  Note: EPS maximization is not the goal of a firm and usually the maximum EPS doesn't occur at the same capital structure where the stock price is maximized or the WACC is minimized.

Table 13-3 Bigbee's Stock Price and WACC Estimates with Different Debt/Assets Ratios

Debt/ Assets (1)	Debt/ Equity[a] (2)	A-T r_d (3)	Expected EPS (and DPS)[b] (4)	Estimated Beta[c] (5)	$r_s = [r_{RF} + (RP_M)b]$[d] (6)	Estimated Price[e] (7)	Resulting P/E Ratio (8)	WACC[f] (9)
0%	0.00%	4.8%	$2.40	1.50	12.0%	$20.00	8.33×	12.00%
10	11.11	4.8	2.56	1.60	12.4	20.65	8.06	11.64
20	25.00	5.0	2.75	1.73	12.9	21.33	7.75	11.32
30	42.86	5.4	2.97	1.89	13.5	21.90	7.38	11.10
40	66.67	6.0	3.20	2.10	14.4	22.22	6.94	11.04
50	100.00	7.2	3.36	2.40	15.6	21.54	6.41	11.40
60	150.00	9.0	3.30	2.85	17.4	18.97	5.75	12.36

[a] $D/E = \frac{D/A}{1 - D/A}$

[b] Bigbee pays all of its earnings as dividends, so EPS = DPS.

[c] The firm's unlevered beta, b_U, is 1.5. The remaining betas were calculated using the Hamada equation, given the unlevered beta, tax rate, and D/E ratio as inputs.

[d] We assume that r_{RF} = 6% and RP_M = 4%. Therefore, at D/A = 0, r_s = 6% + (4%)1.5 = 12%. Other values of r_s are calculated similarly.

[e] Since all earnings are paid out as dividends, no retained earnings will be plowed back into the business and growth in EPS and DPS will be zero. Hence, the zero growth stock price model developed in Chapter 9 can be used to estimate the price of Bigbee's stock. For example, at D/A = 0,

$$P_0 = \frac{DPS}{r_s} = \frac{\$2.40}{0.12} = \$20$$

Other prices were calculated similarly.

[f] Column 9 values are found with the weighted average cost of capital (WACC) equation developed in Chapter 10:

$$\begin{aligned} WACC &= w_d r_d(1 - T) + w_c r_s \\ &= (D/A)(r_d)(1 - T) + (1 - D/A)r_s \end{aligned}$$

For example, at D/A = 40%,

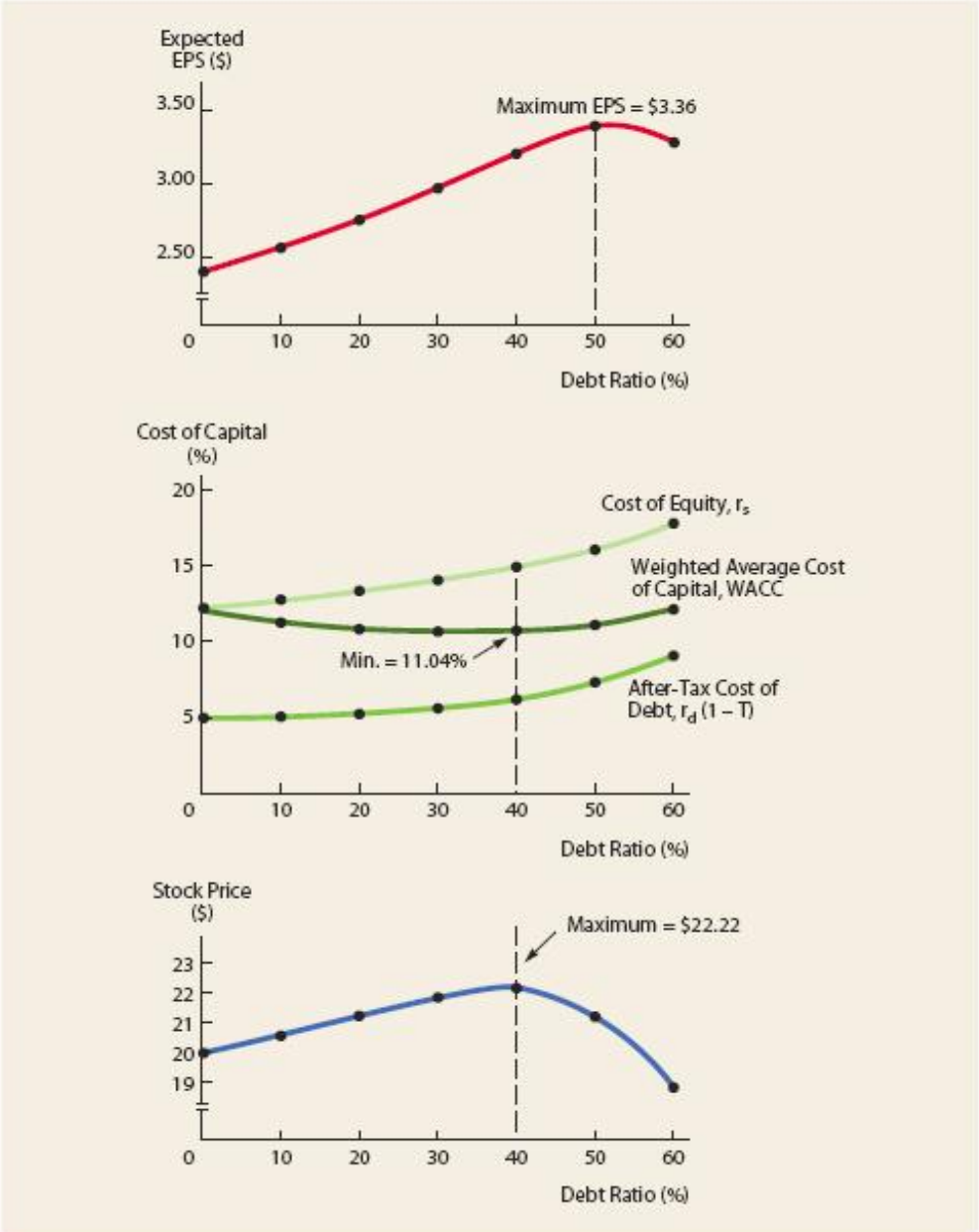
$$WACC = 0.4(10\%)(0.6) + 0.6(14.4\%) = 11.04\%$$

We use book weights here, but market value weights theoretically would be better. See Eugene F. Brigham and Phillip R. Daves, *Intermediate Financial Management*, 9th ed. (Mason, OH: Thomson/South-Western, 2007), Chapter 10, for a discussion of this point.

The optimal capital structure occurs when the firm has 40% of debt and 60% of equity. At that capital structure, the stock price is maximized (at $22.22) and WACC is minimized (at 11.04%).

EPS is maximized when the firm has 50% debt and 50% equity.

FIGURE 13-8 Effects of Capital Structure on EPS, Cost of Capital, and Stock Price



- Capital structure theories

  Assumptions: perfect capital markets with no taxes, homogeneous information, EBIT is not affected by using debt, and investors can borrow at the same rate as corporations

  Irrelevance theory (MM 58): capital structure doesn't matter; the capital structure does not affect stock price or the overall cost of capital

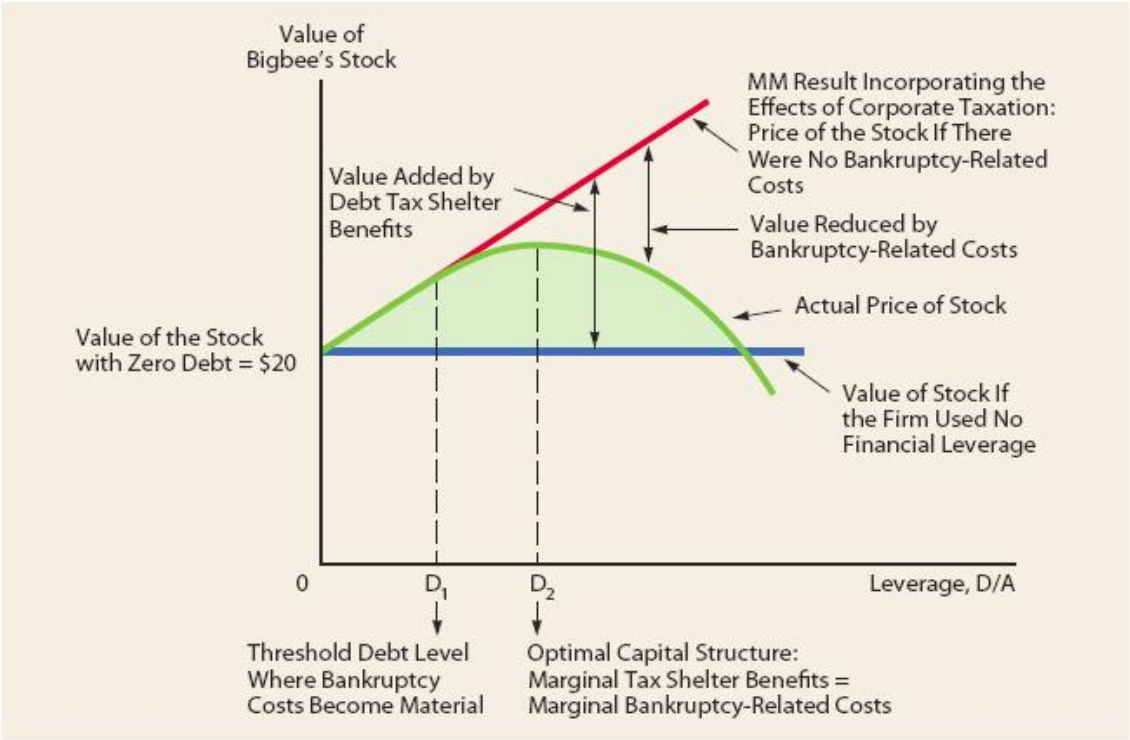
  The effect of taxes (MM 63): if corporate taxes are considered, stock price and overall cost of capital will be affected by the capital structure. The higher the debt, the lower the overall cost of capital, the higher the stock price.

  The trade-off model: corporate taxes are considered and firms may fail
  Costs of financial distress include bankruptcy-related costs
  Benefits from tax shields

  The greater the use of debt, the larger the fixed interest charges, the greater the probability that a firm will go bankruptcy. At the same time, the greater the use of debt, the larger the tax shields.

  $V_L = V_U$ + PV(tax shields) - PV(financial distress and agency costs)

FIGURE 13-9 Effect of Leverage on the Value of Bigbee's Stock



Implication of trade-off model:
Higher-risk firms should borrow less
Firms with tangible assets can borrow more
Firms in higher tax bracket can borrow more

Signaling theory: asymmetric information means that investors and management have different information. Any change in capital structure reveals inside information. For example, a firm issues new stock to raise money is viewed as a negative signal which causes stock price to drop.

- **Exercise**

  ST-1, ST-2, and ST-3
  Problems: 2, 4, 6, and 9*

  Problem 9: assets of $5 million and no debt; tax rate is 40%; NI is $1 million; dividend payout ratio is 40%; NI is expected to grow at 5% per year (constant); 200,000 shares outstanding; and WACC is 13.4% (cost of equity, r_s is 13.4%)
  Considering recapitalization: issue $1 million debt at a cost of 11% before tax and use the proceeds to buy back stocks; the new cost of equity will rise to 14.5%

  Question a: What is the current stock price?

  The current dividend per share D_0 = $400,000/200,000 = $2.00
  Since the growth rate is 5% then dividend next year D_1 = $2.00*(1 + 5%) = $2.10
  Therefore, $P_0 = D_1/(r_s - g)$ = $2.10/(0.134 – 0.05) = $25.00

  Question b: What would be the stock price after recapitalization?

  Step 1 Calculate EBIT before the recapitalization:
  EBIT = $1,000,000/(1 – T) = $1,000,000/0.6 = $1,666,667
  Note: The firm is 100% equity financed, so there is no interest expense

  Step 2 Calculate net income (NI) after the recapitalization:
  [$1,666,667 – 0.11($1,000,000)]*0.6 = $934,000

  Step 3 Calculate the number of shares outstanding after the recapitalization:
  200,000 – ($1,000,000/$25) = 160,000 shares

  Step 4 Calculate D_1 after the recapitalization:
  D_0 = 0.4*($934,000/160,000) = $2.335
  D_1 = $2.335(1.05) = $2.45175

  Step 5 Calculate P_0 after the recapitalization:
  $P_0 = D_1/(r_s - g)$ = $2.45175/(0.145 – 0.05) = $25.81

Chapter 14 -- Dividend Policy

- Dividend vs. retained earnings
- Dividend policy: three basic views
- The clientele effect
- The information content or signaling hypothesis
- Dividend policy in practice
- Dividend payment procedures
- Factors influencing dividend policy
- Stock repurchase, stock dividends and stock splits

- Dividend vs. retained earnings

  Dividend payout ratio vs. profit retention ratio: a review
  Higher dividends mean lower retained earnings, which means lower growth rate and less capital gains

- Dividend policy: three basic views

  Dividend policy: to determine the optimal payout ratio to maximize the stock price

  View 1: dividend policy is irrelevant (Irrelevance Theory by MM 1961)

  Assumptions: perfect capital markets with no taxes, no transaction costs, no flotation costs, etc.

  Result: dividend policy doesn't matter; dividend policy does not affect the stock price or the overall cost of capital

  View 2: high dividends increase stock price (Bird-in-the-hand theory 1979)

  Result: investors feel more secure to receive cash dividends than the income from capital gains. Therefore, the higher the cash dividend, the better the stock

  View 3: low dividends increase stock price (Tax differential theory 1979)

  The tax rates on cash dividends were higher than the tax rates on long-term capital gains before 2003. In addition, capital gains tax can be delayed until the stocks are sold (time value of money) or can be avoid if stocks are passed to beneficiaries provided the original owner passes away.

  Result: the lower the cash dividend, the better the stock

- The clientele effect
  Different dividend policies will attract different investors

- The information content or signaling hypothesis
  Information asymmetry: insiders and outsiders have different information

  Dividends reveal some inside information about firm's future profitability. By increasing dividends, managers signal to the market that the firm will have enough earnings to support future projects.

  Result: an increase in dividend is regarded as a good signal, which causes the stock price to go up.

- Dividend policy in practice
  Residual dividend model
  A model that states that the dividends to be paid should equal to the capital left over after financing of profitable investments.

  Example:
  Target capital structure: 70% debt, 30% equity to raise funds
  The firms now needs $1,200,000 and has NI = $450,000
  Question: what should be the amount of dividend?
  Answer: $1,200,000*(0.3) = $360,000 should be raised from equity (retained)
  Dividend = NI - R/E = 450,000 - 360,000 = $90,000
  Question: If the company has 1,000,000 shares outstanding, what is DPS?
  Answer: DPS = $0.09/share

  Example: T&W's dividend payout ratio under residual dividend policy

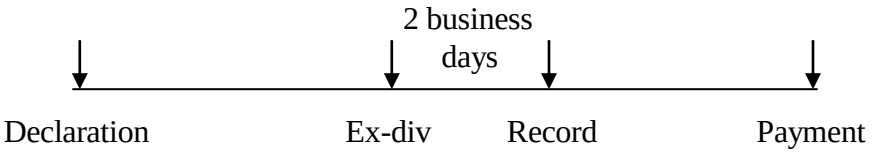
Table 14-2 T&W's Dividend Payout Ratio with $60 Million of Net Income When Faced with Different Investment Opportunities (Dollars in Millions)

	INVESTMENT OPPORTUNITIES		
	Poor	Average	Good
Capital budget	$40	$70	$150
Net income (NI)	$60	$60	$ 60
Required equity (0.6 × Capital budget)	24	42	90
Dividends paid (NI − Required equity)	$36	$18	($ 30)[a]
Dividend payout ratio (Dividends/NI)	60%	30%	0%

[a]With a $150 million capital budget, T&W would retain all of its earnings and issue $30 million of new stock.

  Alternatives:
  Constant dividend payout ratio
  Stable dividend per share
  Low regular dividend plus extras when time is good

- Dividend payment procedure
  Declaration date
  Holder-of record date
  Ex-dividend date: two business days prior to the holder-of record date
  Payment date



  Tax implications: if you buy the stock before Ex-dividend date, you will receive dividend (but you pay a higher price); if you buy the stock after Ex-dividend date, you will not receive dividend (but you pay a lower price).

- Factors influencing dividend policy
  Constraints:
  Bond indenture
  Preferred stock restrictions
  Impairment of capital structure: dividends cannot exceed the balance sheet item R/E
  Availability of cash
  Penalty tax on improperly accumulated earnings

  Investment opportunities:
  Profitable investment opportunities
  Possibility of accelerating or delaying projects

  Alternative sources of capital:
  Cost of selling new stock
  Ability to substitute debt for equity
  Control of the company

  Effects of dividend policy on cost of equity

- Stock repurchase, stock dividend and stock splits
  Stock repurchase: reduction of shares outstanding
  Internal investment opportunity
  Capital structure
  Increase in EPS
  Ownership
  Tax advantage

  Stock dividend: a distribution of shares up to 25% of the number of shares currently outstanding, issued on a pro rata basis to the current stock holders

Stock splits: a stock dividend exceeding 25% of the number of shares currently outstanding

After stock dividend or stock split, the number of shares outstanding increases, earnings per share, dividend per share, and stock price all decline

Why stock dividends and/or stock splits?
Conserve cash
Optimal stock price range
Positive signals
Higher total value

- **Exercise**

  ST-1 and ST-2
  Problems: 1, 2, 3, 4, 5 and 6*

  Problem 6: a firm has three independent projects, each of them requires $5 million investment:

Project H (high risk)	Cost of capital = 16%	IRR = 20%
Project M (medium risk)	Cost of capital = 12%	IRR = 10%
Project L (low risk)	Cost of capital = 8%	IRR = 9%

  The optimal capital structure is 50% debt and 50% equity. The expected net income (NI) is $7,287,500. If the firm adopts the residual dividend model, what will be the firm's dividend payout ratio?

  Answer: the firm should choose Projects H and L since IRR > cost of capital for both H and L, which means that the firm needs to raise $10 million

  According to the optimal capital structure:
  $10 million*(0.5) = $5 million will be raised from debt
  $10 million*(0.5) = $5 million will be raised from equity (retained from NI)

  Dividends = NI - R/E = 7,287,500 - 5,000,000 = $2,287,500
  Payout ratio = Dividends / NI = 2,287,500 / 7,287,500 = 31.39%

Chapter 15 -- Working Capital Management

- Working capital, net working capital, and net operating working capital
- Current asset investment and financing policies
- Cash conversion cycle
- Cash and marketable securities
- Inventories
- A/R and A/P (trade credit)
- Bank loans

- Working capital, net working capital, and net operating working capital

  Working capital refers to current assets

  Net working capital = currents assets - current liabilities

  Net operating working capital = current assets - (current liabilities - notes payable)

- Current assets investment and financing policies

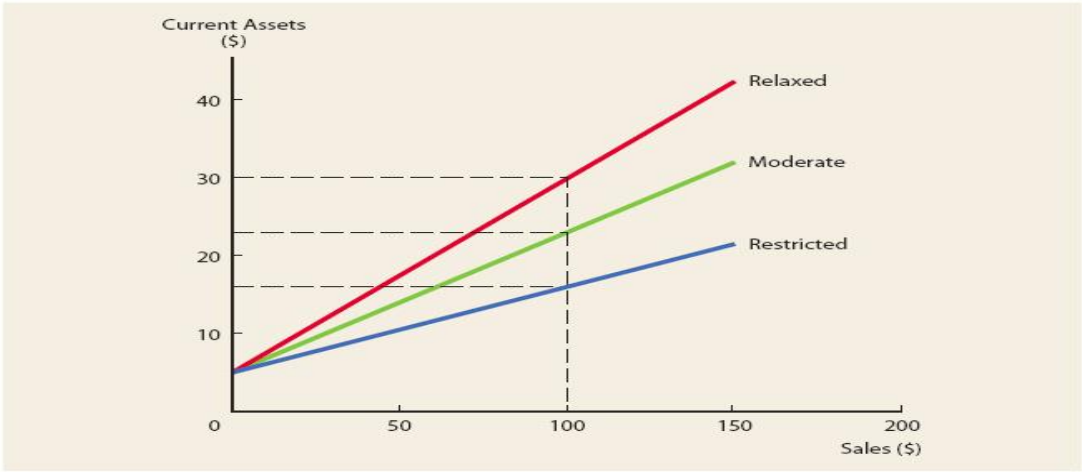
  Current assets investment policy: how much current assets a firm should have

  Relaxed current asset policy: carry a relatively large amount of current assets along with a liberal credit policy with a high level of A/R

  Restricted current asset policy: carry constrained amount of current assets along with restricted credit policy

  Moderate current asset policy: in between the relaxed and restricted policies

FIGURE 15-1 Current Asset Investment Policies (Millions of Dollars)

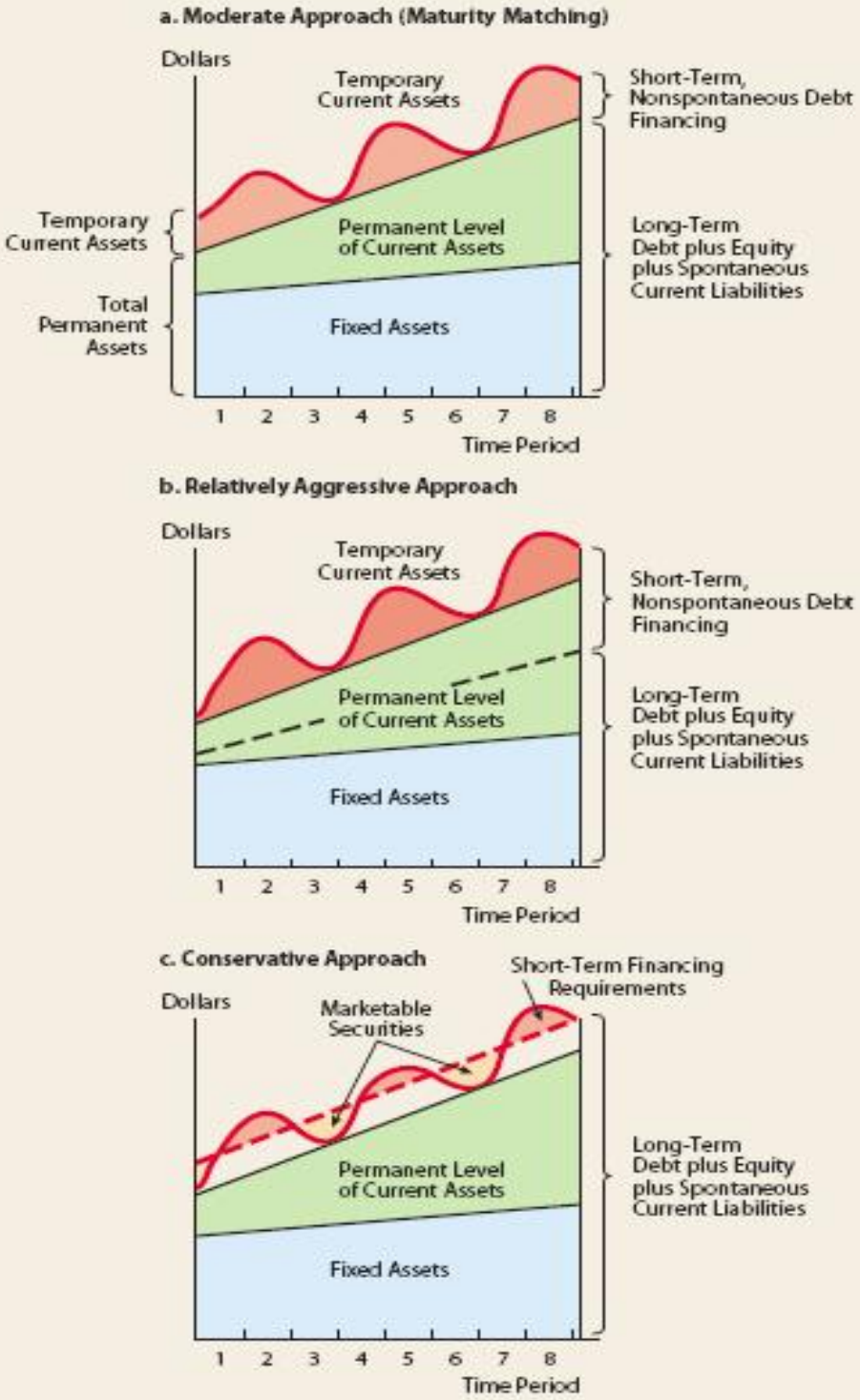


Policy	Current Assets per $100 of Sales	Turnover of Current Assets: Sales/CA
Relaxed	$30	3.3x
Moderate	23	4.3
Restricted	16	6.3

Note: The sales/current assets relationship is shown here as being linear, but the relationship could be curvilinear.

  Current asset financing policy: the way current assets are financed

FIGURE 15-2 Alternative Current Asset Financing Policies



Permanent assets vs. temporary assets
Permanent assets: to be held for more than one year
Temporary assets: to be held for less than one year

Maturity matching approach: a policy that matches asset and liability maturities and it is a moderate policy

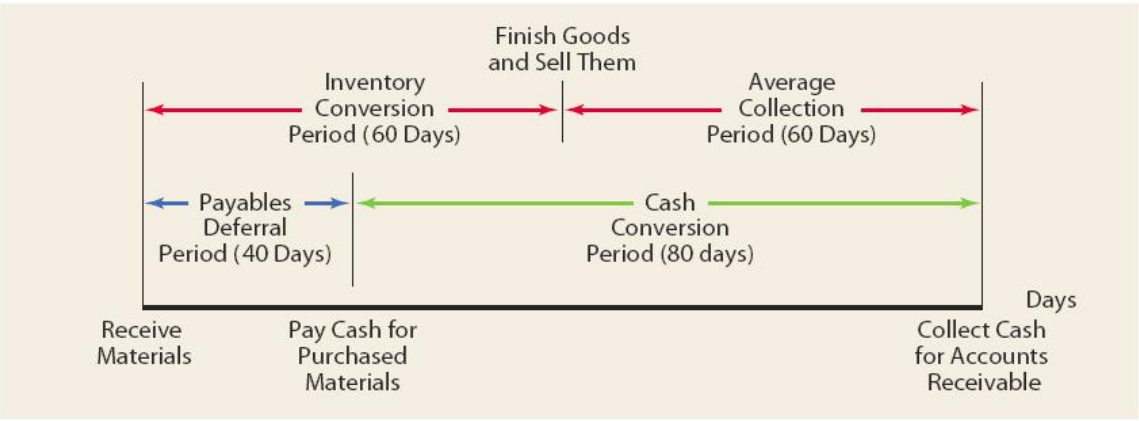
Aggressive approach: uses more short-term, non-spontaneous debt financing
Conservative approach: uses more long-term debt and equity financing

Permanent assets should be financed by intermediate and long-term debt, preferred stock, and common stock.

Temporary assets should be financed by notes and short-term loans.

- Cash conversion cycle
  (1) The cash conversion cycle (CCC)
  The average length of time funds are tied up in working capital or the length of time between paying for working capital and collecting cash from the sale of the working capital
  (2) Inventory conversion period (days of sales in inventory, DSI)
  The average time required to convert materials into finished goods and then sell them
  (3) Average collection period (ACP)
  The average length of time required to convert the firm's receivables into cash
  (4) Payables deferral period (days of payable outstanding, DPO)
  The average length of time between the purchase of materials and labor and the payment of cash for them

FIGURE 15-3 The Cash Conversion Cycle



The relationship is: DPO + CCC = DSI + ACP, or CCC = DSI + ACP - DPO

Minimizing working capital: speeding cash collection (reducing ACP), increasing inventory turnovers (reducing DSI), and slowing down cash disbursement (increasing DPO)

- Cash and marketable securities

  Refer to currency and demand deposits in addition to very safe and highly liquid marketable securities that can be sold quickly at a predictable price and thus be converted to bank deposits

- Inventories

  Include supplies, raw materials, work-in-process, and finished goods

- A/R and A/P (trade credit)

  A/R: funds due from customers

  Credit policy: a set of rules that includes credit period, discounts, credit standards, and collection policy

  Credit terms: for example, 2/10, net 30 means that the firm allows a 2% price discount if payment is received within 10 days of the purchase; if the discount is not taken, the full payment is due in 30 days

  Credit score: a numerical score from 1 to 10 that indicates the likelihood that a person or business will pay on time

  A/P (trade credit): debt arising from credit sales and recorded as an account receivable by the seller and as an account payable by the buyer

  Trade credit may be free or it may be costly. For example, the terms 2/10, net 30 are offered when a firm makes the purchase on its credit card. Assuming 365 days per year,

$$\text{Nominal annual cost of trade credit} = \frac{\text{discount}}{100 - \text{discount}} * \frac{365}{\text{credit days} - \text{discount days}}$$

$$= \frac{2}{100 - 2} * \frac{365}{30 - 10} = 37.24\%$$

- Bank loans

  Promissory note: a document specifying the terms and conditions of a loan

  Line of credit: an agreement in which a bank agrees to lend up to a specified maximum amount of funds during a designated period

  Cost of bank loans:

  $$\text{Annual Percentage Rate (APR)} = \frac{\text{interest}}{\text{principal}} * \frac{1}{\text{time}}$$

  For example, if XYZ borrows $1,000 for 3 month and repay the principal plus $30 interest at maturity, assuming 30 days per month and 12 months per year, then

  $$\text{APR} = \frac{30}{1{,}000} * \frac{1}{90/360} = 12\%$$

  Annual Percentage Yield (APY)

  $$APY = (1 + \frac{i}{m})^m - 1$$

  APY = 12.6% for XYZ

  Accrued wages and taxes

  Commercial papers: unsecured, short-term promissory notes issued by large firms

- **Exercise**

  ST-1 and ST-2

  Problems: 1, 3, and 4