

## 5: NET PRESENT VALUE AND OTHER INVESTMENT CRITERIA

### NPV METHOD

1. Forecast expected CFs over project life
2. Determine the cost of capital,  $k$
3. Compute project NPV
4. Decide

Ex. 1. Consider the following projects:

Project	Cash Flows (\$)					
	$C_0$	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$
A	-1,000	+1,000	0	0	0	0
B	-2,000	+1,000	+1,000	+4,000	+1,000	+1,000
C	-3,000	+1,000	+1,000	0	+1,000	+1,000

a. If the opportunity cost of capital is 10%, which projects have a positive NPV?

Why does the NPV method make sense?

## **Key Features of NPV Rule**

- 1. Recognizes time value of money**
- 2. Objective: Depends only on CFs and k**
- 3. NPVs are additive**

## **ALTERNATIVE METHODS**

### **1. PAYBACK PERIOD**

**Decision Rule: Accept if  $PP < n$  Years**

**PP = Number of years it takes for the cumulative CFs to equal the initial investment**

**Ex. 1 (see above)**

**b. Calculate the payback period for each project.**

**c. Which project(s) would a firm using the payback rule accept if the cutoff period was three years?**

**Problems with PP Method:**

- 1. Gives equal weight to all CFs before PP**
- 2. Gives no weight to CFs after PP**
- 3. Need to choose a cut-off PP**

**2. DISCOUNTED PAYBACK PERIOD**

**Decision Rule: Accept if DPP < n Years**

**DPP = Number of years it takes for the cumulative DCFs to equal the initial investment**

**Ex. 1 (see above)**

**d. Calculate the discounted payback period for each project.**

**e. Which project(s) would a firm using the discounted payback rule accept if the cutoff period was three years?**

## **Problems with DPP Method**

**Overcomes problem 1 with the PP method, but not 2 or 3**

## **3. AVERAGE ACCOUNTING RETURN (ARR)**

**D.R.: Accept if  $ARR_{\text{project}} > ARR_{\text{firm or ind.}}$**

**$ARR = \text{Average accounting profits after taxes} / \text{Average investment}$**

## **Problems with ARR Method**

- **Ignores time value of money**
- **Relies on accounting income (subjective), not CFs (objective)**
- **Cut-off ARR based on firm's existing business, not project risk**

## **4. INTERNAL RATE OF RETURN**

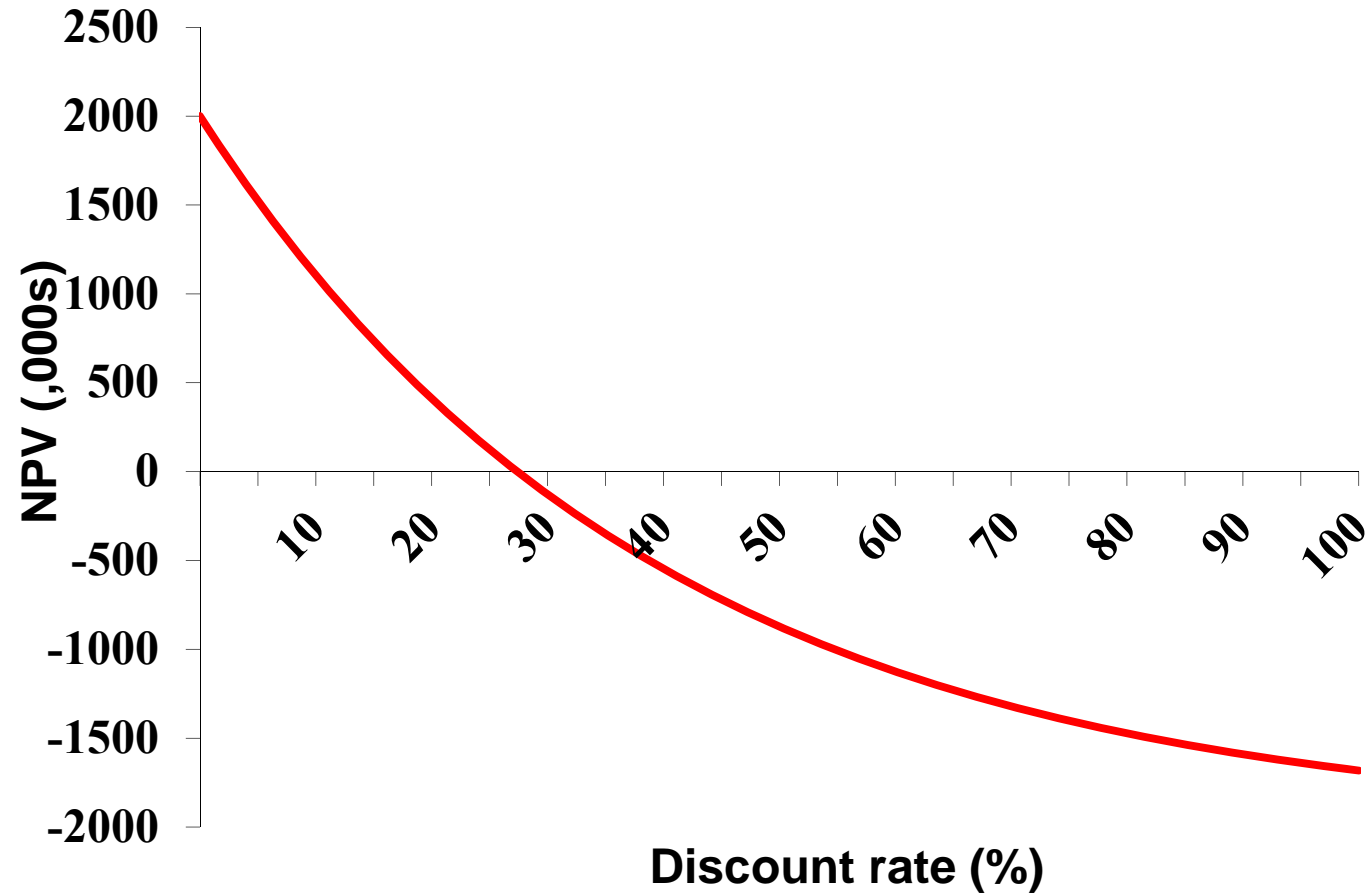
**D.R.: Accept if  $IRR > k$**

**$IRR = \text{Discount rate } k \text{ at which } NPV=0$**

**Ex. 2. You can purchase a turbo powered machine tool gadget for \$4,000. The investment will generate \$2,000 and \$4,000 in cash flows for two years, respectively. What is the IRR on this investment?**

$$NPV = -4,000 + \frac{2,000}{(1+IRR)^1} + \frac{4,000}{(1+IRR)^2} = 0$$

$$IRR = 28.08\%$$



## IRR

### Pitfall 1 - Lending or Borrowing?

- With some cash flows (as noted below) the NPV of the project increases as the discount rate increases.
- This is contrary to the normal relationship between NPV and discount rates.

Project	$C_0$	$C_1$	IRR	NPV @ 10%
A	-1,000	+1,500	+50%	+364
B	+1,000	-1,500	+50%	-364

### Pitfall 2 - Multiple Rates of Return

- Certain cash flows can generate NPV=0 at two different discount rates.
- The following cash flow generates NPV=\$ 0.253 million at  $k = 10\%$ , but IRRs of +3.50% and +19.54%.

#### Cash Flows (\$ millions)

$C_0$	$C_1$ .....	.....	$C_9$	$C_{10}$
-3	1		1	-6.5

**Pitfall 3 – Sometimes an IRR does not exist, but NPV always does!**

Project	$C_0$	$C_1$	$C_2$	IRR	NPV@10%
<i>C</i>	+1,000	+3,000	+2,500	None	+5793

**Pitfall 4 - Mutually Exclusive Projects**

**IRR sometimes ignores the magnitude of the project.**

Project	$C_0$	$C_1$	IRR	NPV @ 10%
<i>D</i>	-10,000	+20,000	100%	+8,182
<i>E</i>	-20,000	+35,000	+75%	+11,818

**Pitfall 5 – The Opportunity cost of capital sometimes varies over time**

## 5. PROFITABILITY INDEX

**D.R.: Accept if  $PI > 1$**

$$PI = (INV + NPV) / INV$$

**Ex.**

Project	Investment(\$m)	NPV(\$m)	Profitability Index
A	10	21	3.1
B	5	16	4.2
C	5	12	3.4
D	32.5	13	1.4

- Which projects do we accept based on PI and why?**
- Are the decisions consistent with the NPV method?**
- How would you rank these projects according to PI and NPV methods?**



# **MAKING INVESTMENT DECISIONS UNDER CAPITAL RATIONING**

## **CAPITAL RATIONING**

### **TYPES OF CAPITAL RATIONING**

#### **SOFT: Financial control tool**

- **Optimistic forecasts by divisions**
- **Tool to limit growth**

#### **HARD: Market imperfection**

- **Inability to borrow, unwillingness to issue equity**
- **Inability to communicate project quality to investors**

### **DECISION MAKING UNDER CAPITAL RATIONING**

#### **SINGLE CONSTRAINTS**

#### **MULTIPLE CONSTRAINTS**

## 6: MAKING INVESTMENT DECISIONS WITH THE NPV RULE

### WHAT TO DISCOUNT?

- Cashflows (CFs), not accounting profits
- Treat inflation consistently

**Ex.** You invest in a project that will produce real cash flows of -\$100 in year zero and then \$35, \$50, and \$30 in the three respective years. If the nominal discount rate is 15% and the inflation rate is 10%, what is the NPV of the project?

$$\begin{aligned}\text{real discount rate} &= \frac{1 + \text{nominal discount rate}}{1 + \text{inflation rate}} - 1 \\ &= \frac{1.15}{1.10} - 1 = .045\end{aligned}$$

- **Estimate incremental CFs of the project**
  - **Use incremental, not average, payoffs**
  - **Include all incidental effects**
  - **Include CF effects of working capital requirements**
  - **Ignore sunk costs**
  - **Include opportunity costs**
  - **Ignore allocated overheads**
- **Discount after-tax CFs at after-tax  $k$**

## **EVALUATING DIFFERENT TYPES OF PROJECTS**

- **Should we invest now or later? (Investment timing)**
- **Choice between long-lived vs. short-lived machine (Equivalent Annual CFs)**
- **When do we replace a machine? (Equivalent Annual CFs)**
- **How much do we use a machine?**
- **How much is depreciation tax shield worth?**

## INVESTMENT TIMING

Sometimes you can defer an investment to a more suitable time.

**Ex. A tree farm:** You can defer the harvesting of trees. By doing so, you defer the receipt of CFs, yet increase them.

**Ex. You own a large tract of inaccessible timber.** To harvest it, you have to invest a substantial amount in access roads and other facilities. The longer you wait, the higher the investment required. On the other hand, lumber prices will rise as you wait, and the trees will keep growing, although at a gradually decreasing rate. Given the following data and a 10% discount rate, when should you harvest?

	Year of Harvest					
	0	1	2	3	4	5
Net <i>future</i> value (\$ thousands)	50	64.4	77.5	89.4	100	109.4
Change in value from previous year (%)		+28.8	+20.3	+15.4	+11.9	+9.4

	Year of Harvest					
	0	1	2	3	4	5
Net present value (\$ thousands)	50	58.5	64.0	67.2	68.3	67.9

## INVESTMENT TIMING

**Ex. You may purchase a computer anytime within the next five years. While the computer will save your company money, the cost of computers continues to decline. If your cost of capital is 10% and given the data listed below, when should you purchase the computer?**

Year	Cost	PV Savings	NPV at Purchase	NPV Today
0	50	70	20	20.0
1	45	70	25	22.7
2	40	70	30	24.8
3	36	70	34	25.5
4	33	70	37	25.3
5	31	70	39	24.2

## EQUIVALENT ANNUAL CFs

**EAF = CF per period with the same PV as the actual CF of the project**

$$\text{EAF} = \frac{\text{PV of cash flows}}{\text{PV of a \$1 Annuity (i.e., PVA)}}$$

**$\text{PVA}_{k,T}$  = PV of a T-year \$1 annuity (i.e., \$1 per year starting in year 1) at discount rate k**

## EQUIVALENT ANNUAL CFs

**Ex. Given the following cash flows from operating two machines and a 6% cost of capital, which machine has the higher value using equivalent annual cashflow method.**

Cash flows (\$ millions)							
Machine	$C_0$	$C_1$	$C_2$	$C_3$	$PV_{6\%}$	$PVA_{6\%}$	EAC
A	-15	+10	+10	+10	11.73	2.673	4.39
B	-10	+8	+8		4.67	1.833	2.55

**Ex. Select one of the two following projects, based on highest equivalent annual cash flow (k=9%).**

Cash flows (\$ millions)							
Project	$C_0$	$C_1$	$C_2$	$C_3$	$C_4$	$NPV$	$EAF$
$C$	-15	4.9	5.2	5.9	6.2	2.82	0.87
$D$	-20	8.1	8.7	10.4		2.78	1.1

$$PVA_{9\%,4} = 3.2397$$

$$PVA_{9\%,3} = 2.5313$$

## MAKE VS. BUY

**Ex.** A widget manufacturer currently produces 200,000 units a year. It buys widget lids from an outside supplier at a price of \$2 a lid. The plant manager believes that it would be cheaper to make these lids rather than buy them. Direct production costs are estimated to be only \$1.50 a lid. The necessary machinery would cost \$150,000 and would last 10 years. This investment could be written off for tax purposes using the seven-year tax depreciation schedule. The plant manager estimates that the operation would require additional working capital of \$30,000 but argues that this sum can be ignored since it is recoverable at the end of the 10 years. If the company pays tax at a rate of 35% and the opportunity cost of capital is 15%, would you support the plant manager's proposal? State clearly any additional assumptions that you need to make.

**PV of after-tax CFs over 10 years (\$K):**

**Buy:**  $-200 (2) (PVA_{10, 15\%}) (1 - .35) = -\$1,304.88 \text{ K}$

**Make:**  $-150 - 30 - 200 (1.5) (1 - .35) PVA_{10, 15\%} + 30 PV_{10, 15\%} + 150 (.35) [.1429/1.15 + .2449/1.15^2 + \dots + .0445/1.15^8] = -\$1,118.33 \text{ K}$

**$PVA_{10, 15\%} = 5.0188$**

## Chapter 6 Making Investment Decisions with the Net Present

**Tax Depreciation Schedules by Recovery-Period Class**

	<b>Year(s)</b>	<b>3-year</b>	<b>5-year</b>	<b>7-year</b>	<b>10-year</b>	<b>15-year</b>	<b>20-year</b>
1	1	33.33	20.00	14.29	10.00	5.00	3.75
2	2	44.45	32.00	24.49	18.00	9.50	7.22
3	3	14.81	19.20	17.49	14.40	8.55	6.68
4	4	7.41	11.52	12.49	11.52	7.70	6.18
5	5		11.52	8.93	9.22	6.93	5.71
6	6		5.76	8.92	7.37	6.23	5.28
7	7			8.93	6.55	5.90	4.89
8	8			4.46	6.55	5.90	4.52
9	9				6.56	5.91	4.46
10	10				6.55	5.90	4.46
11	11				3.28	5.91	4.46
12	12					5.90	4.46
13	13					5.91	4.46
14	14					5.90	4.46
15	15					5.91	4.46
16	16					2.95	4.46
17	17-20						4.46
18	21						2.23



### Practice Problems

1. Low-energy lightbulbs cost \$3.50, have a life of nine years, and use about \$1.60 of electricity a year. Conventional lightbulbs cost only \$.50, but last only about a year and use about \$6.60 of energy. If the real discount rate is 5%, what is the equivalent annual cost of the two products?

2. The Borstal Company has to choose between two machines that do the same job but have different lives. The two machines have the following costs in real terms. Which machine should Borstal buy? Assume a 6% real discount rate and ignore taxes.

Year	Machine A	Machine B
0	\$40,000	\$50,000
1	10,000	8,000
2	10,000	8,000
3	10,000 + replace	8,000
4		8,000 + replace

**3. The president's executive jet is not fully utilized. You judge that its use by other officers would increase direct operating costs by only \$20,000 a year and would save \$100,000 a year in airline bills. On the other hand, you believe that with the increased use the company will need to replace the jet at the end of three years rather than four. A new jet costs \$1.1 million and (at its current low rate of use) has a life of six years. Assume that the company does not pay taxes. All cash flows are forecasted in real terms. The real opportunity cost of capital is 8%. Should you try to persuade the president to allow other officers to use the plane?**

## 9: ESTIMATING PROJECT COST OF CAPITAL

**COST OF CAPITAL FOR A PROJECT = INVESTORS' REQUIRED RATE OF RETURN**

**A TOOL FOR ESTIMATING INVESTORS' REQUIRED RETURN:**

**CAPITAL ASSET PRICING MODEL (CAPM)**

$$k_i = E(r_i) = r_f + \beta_i [E(r_m) - r_f]$$

$$\text{i.e. } E_i = r_f + \beta_i (E_m - r_f)$$

where  $\beta_i = \text{cov}(r_i, r_m) / \text{var}(r_m)$   
 $= \sigma_{im} / \sigma_m^2$

**RELATION BETWEEN  $\beta$  AND  $\sigma$**

**RELATION BETWEEN  $\beta$  AND  $\rho$**

**Ex. The following table shows estimates of the risk of two well-known Canadian stocks:**

	$\sigma$ (%)	$R^2$	Beta	s(Beta)
<b>Toronto Dominion Bank</b>	<b>25</b>	<b>.25</b>	<b>.82</b>	<b>.18</b>
<b>Canadian Pacific</b>	<b>28</b>	<b>.30</b>	<b>1.04</b>	<b>.20</b>

**a. What proportion of each stock's risk is market risk, and what proportion is specific risk?**

**b. What is the variance of Toronto Dominion? What is the specific variance?**

**c. What is the 95% confidence interval on Canadian Pacific's beta?**

**d. If the CAPM is correct, what is the expected return on Toronto Dominion? Assume a risk-free interest rate of 5% and an expected market return of 12%.**

**e. If the market provides a zero return next year, what return do you expect from Toronto Dominion?**

**$\beta$  OF**

- **A PORTFOLIO OF ASSETS**
  
- **THE MARKET PORTFOLIO**
  
- **THE RISKFREE ASSET**

**PROJECT SELECTION WITH CAPM**

**DISCOUNT RATE FOR ALL PROJECTS: COMPANY COST OF CAPITAL?**

**ESTIMATING COST OF CAPITAL (OR  $\beta$ ) FOR DIFFERENT TYPES OF PROJECTS**

- **SCALE EXPANSION**
  
- **COST REDUCTION**
  
- **TYPICAL PROJECT IN ANOTHER INDUSTRY**
  
- **NON-STANDARD PROJECT IN ANOTHER INDUSTRY**

## **MEASURING EQUITY $\beta$**

## **CALCULATING ASSET $\beta$**

**Ex. The total market value of the common stock of the Okefenokee Real Estate Company is \$6 million, and the total value of its debt is \$4 million. The treasurer estimates that the beta of the stock is currently 1.5 and that the expected risk premium on the market is 6%. The Treasury bill rate is 4%. Assume for simplicity that Okefenokee debt is risk-free and the company does not pay tax.**

**a. What is the required return on Okefenokee stock?**

**b. Estimate the company cost of capital.**

**c. What is the discount rate for an expansion of the company's present business?**

**d. Suppose the company wants to diversify into the manufacture of rose-colored spectacles. The beta of unleveraged optical manufacturers is 1.2. Estimate the required return on Okefenokee's new venture.**

## **CALCULATING INDUSTRY $\beta$**

## **DIVISIONAL COST OF CAPITAL**

## **ADJUSTING INDUSTRY $\beta$ FOR A NON-STANDARD PROJECT**

- **CYCLICITY**

- **OPERATING LEVERAGE**

## **PROJECTS WITH VARIABLE DISCOUNT RATES**

**Ex. The McGregor Whisky Company is proposing to market diet scotch. The product will first be test-marketed for two years in southern California at an initial cost of \$500,000. This test launch is not expected to produce any profits but should reveal consumer preferences. There is a 60% chance that demand will be satisfactory. In this case McGregor will spend \$5 million to launch the scotch nationwide and will receive an expected annual profit of \$700,000 in perpetuity. If demand is not satisfactory, diet scotch will be withdrawn. Once consumer preferences are known, the product will be subject to an average degree of risk, and, therefore, McGregor requires a return of 12% on its investment. However, the initial test-market phase is viewed as much riskier, and McGregor demands a return of 20% on this initial expenditure. What is the NPV of the diet scotch project?**

**TREATMENT OF UNCERTAIN CASHFLOWS:  
PV [E(C<sub>t</sub>)] vs. DISCOUNT RATE ADJUSTMENT**

**Ex. Mom and Pop Groceries has just dispatched a year's supply of groceries to the government of the Central Antarctic Republic. Payment of \$250,000 will be made one year hence after the shipment arrives by snow train. Unfortunately there is a good chance of a coup d'état, in which case the new government will not pay. Mom and Pop's controller therefore decides to discount the payment at 40%, rather than at the company's 12% cost of capital.**

**a. What's wrong with using a 40% rate to offset political risk?**

**b. How much is the \$250,000 payment really worth if the odds of a coup d'état are 25%?**



## 10: PROJECT ANALYSIS

**Techniques to analyze:**

- **What could go wrong with the project**
- **Sequential investment decisions**

### 1. SENSITIVITY ANALYSIS

**Assumptions underlie CF forecasts**

**$\Delta$  Assumption  $\rightarrow \Delta$  NPV**

**Express CFs in terms of unknown variables**

**Compute NPV, if all variables, except one, remain constant.**

**Ex. Given the expected cash flow forecasts for Jalopy Motor’s Electric Scooter project shown below, conduct a sensitivity analysis using a 10% cost of capital. What are the principal uncertainties in the project?**

\$ millions	Year 0	Years 1-10
Investment	-150	
Sales		375
- Variable Costs		300
- Fixed Costs		30
- Depreciation		15
= Pretax profit		30
. - Tax @ 50%		15
= Profit after tax		15
Operating cash flow		30
Net Cash Flows	-150	30

$$\text{NPV} = -150 + 30 \text{ PVA}_{10, 10\%} = \$34.2 \text{ million}$$

**Possible Outcomes**

<i>Variable</i>	<i>Range</i>		
	<i>Pessimistic</i>	<i>Expected</i>	<i>Optimistic</i>
Market Size	.8 mil	1.0 mil	1.2 mil
Market Share	.04	.1	.16
Unit price	\$3,000	\$3,750	\$4,000
Unit Var Cost	\$3,500	\$3,000	\$2,750
Fixed Cost	\$50 m	\$30 m	\$10 m

$$\text{Revenue} = \text{Market size} \times \text{Market share} \times \text{Unit price}$$

$$\text{VC} = \text{Market size} \times \text{Market share} \times \text{UVC}$$

## **Use:**

- 1. Identifying the underlying variables**
- 2. Exposes inappropriate forecasts**

## **Problems**

- 1. Ambiguity: “Optimistic”, “Pessimistic”**
- 2. Underlying variables may be related: Considering one at a time may ignore other effects**

## 2. SCENARIO ANALYSIS

**Takes into account interactions among the underlying variables**

**Project analysis given a particular combination of assumptions**

**Identify one or two key (possibly inter-related) variables and consider their joint effect**

**Ex. What is the NPV of the electric scooter project under the following scenario?**

<b>Market size</b>	<b>1.1 million</b>
<b>Market share</b>	<b>.1</b>
<b>Unit price</b>	<b>\$4,000</b>
<b>Unit variable cost</b>	<b>\$3,600</b>
<b>Fixed cost</b>	<b>\$20 million</b>

### **3. BREAK-EVEN ANALYSIS**

**Sensitivity Analysis: How bad will the NPV be if sales and costs are worse than expected?**

**BEA: How much do sales have to be before the project turns positive NPV?**

**Break-even point: Unit sales at which NPV=0**

**Ex. Compute the breakeven point for the electric scooter project.**

**Ex. BK Toys just bought a \$200,000 machine to produce toy cars. The machine will be fully depreciated by the straight line method over its 5-year economic life. Each toy sells for \$25. The variable cost per toy is \$5, and the firm incurs fixed costs of \$350,000 each year. If the corporate tax rate is 25% and the discount rate is 8%, what is the break-even point for the project?**

#### 4. DECISION TREES

Useful for explicitly analyzing sequential decisions

Ex. Big Oil is considering whether to drill for oil in Westchester County. The prospects are as follows:

Depth of well, Feet	Total Cost, \$ millions	Cum. Prob. of Finding Oil	PV of Oil (if found), \$ millions
1,000	2	.5	5
2,000	2.5	.6	4.5
3,000	3	.7	4

Draw a decision tree showing the successive drilling decisions to be made by Big Oil. How deep should it be prepared to drill?

**Merits:**

- 1. If today's decision affects tomorrow's opportunities, you must consider that.**
- 2. It forces you to explicitly consider the future investment and operating strategy, which any CF forecast implicitly considers.**

**Problem: Can easily get very involved**

**Use: A convenient way to consider key sequential decisions, but not the entire sequence of decisions**



## **14: OVERVIEW OF CORPORATE FINANCING**

### **COMMON STOCK**

- **Ownership**
- **Residual claim**
- **Rights of stockholders**
  - **Pre-emptive rights**
  - **Voting rights (Simple majority vs. Cumulative)**
- **Classes**
- **Dividends**
  - **Taxation**
- **Life**

### **CORPORATE DEBT**

- **Promises**
- **Limited liability**
- **Voting rights**

## **CORPORATE DEBT (cont.)**

- **Tax treatment of interest**
- **Indenture**
- **Maturity**
- **Repayment**
- **Seniority**
- **Interest rate**
- **Loans raised abroad**
- **Substitutes for debt**

## **PREFERRED STOCK**

- **Hybrid of debt and equity**
- **Life**
- **Dividend**
- **Claim upon bankruptcy**

## **PREFERRED STOCK (cont.)**

- **Repayment**
- **Indenture**
- **Voting**
- **Dividends**
  - **Taxation**

## **WARRANTS**

- **Call options**
- **Issued with bonds**
- **Traded publicly**

## **CONVERTIBLES**

- **Bond or Preferred stock**
- **Used in project financing**

**Simple majority vs. Cumulative Voting: Suppose a company's Board of Directors has D seats. If the company has N shares outstanding, how many shares does an investor need under each voting system to control d seats?**

**Simple majority:  $.5N + 1$**

**Cumulative Voting:  $[Nd / (D+1)] + 1$**

**Ex. Suppose Trinity Foods Inc. has 10 million shares outstanding and has 8 seats on its board. How many shares does an investor need to guaranty election of one director of its choice (i.e., to control one Board seat) under simple majority voting and under cumulative voting system?**

## **15: HOW COMPANIES ISSUE SECURITIES**

### **VENTURE CAPITAL**

**Seasoned**

**General cash offer**

**Public issue**

**Initial (IPO)**

### **NEW ISSUES**

**Rights offer**

**Private placement**

## **PROCEDURE FOR A PUBLIC ISSUE**

- **Board approval**
- **Stockholders' approval**
- **File Registration statement with SEC**
- **Preliminary prospectus**
- **Final Prospectus**
- **Tombstone ad**

## **ISSUE COSTS**

- **Administration**
- **Underwriting**
- **Underpricing**

## **UNDERWRITING**

- **Types of contracts**
  - Fixed commitment**
  - Best efforts**
  - All or none**

**UNDERWRITING (cont.)**

**General cash offer: Spread**

- **Fee**

**Rights issue: Standby + Take-up**

**Negotiation**

- **Contracting**

**Competitive bids**

- **Organization**

**Manager**

**U<sub>1</sub> U<sub>2</sub> U<sub>3</sub> U<sub>4</sub> (Syndicate)**

**S<sub>1</sub> S<sub>2</sub> S<sub>3</sub> S<sub>4</sub> (Selling Group)**

## **UNDERWRITING (cont.)**

- **Price stabilization**
  
- **Major underwriters**

## **RIGHTS ISSUES (PRIVILEGED SUBSCRIPTION)**

- **Registration procedure**
  
- **Selling Procedure**
  
- **Underpricing**
  
- **Valuation**



## Rights Valuation

If the stock price before a rights issue (i.e., cum-rights price) is  $p_b$  and 1 new share is issued for each  $n$  shares held at  $p_o$ , then the value of a right,

$$p_r = (p_b - p_o) / (n+1), \text{ and}$$

the stock price after the rights issue (i.e., ex-rights price),  $p_a = p_b - p_r$

**Ex. In 2001 the Pandora Box Company made a rights issue at €5 a share of one new share for every four shares held. Before the issue there were 10 million shares outstanding and the share price was €6.**

- a. What was the total amount of new money raised?**
- b. What was the value of the right to buy one new share?**
- c. What was the prospective stock price after the issue?**
- d. How far does the company's market capitalization need to fall before shareholders would be unwilling to take up their rights?**

## **SHELF REGISTRATION**

**SEC Rule 415 (1982)**

**Single registration statement for all future financing needs over next 2 years**

## **PRIVATE PLACEMENT**

**<12 investors**

**No registration**

**Debt issues: Custom-tailored**

**“Letter stock”**

**Liquidity**

**Interest rate**

**SEC Rule 144a (1990)**

## **16: DIVIDEND POLICY**

### **Forms of dividends**

Cash dividends

Regular

Extra

Special

Tax treatment

Liquidating dividends

Stock dividends

Stock split

**Div. Reinvestment Plans (DRIPs)**

**Stock Repurchase**

## **How are dividends paid?**

- Board decision

- Dates

  - Announcement

  - Ex

  - Record

  - Payment

## **Constraints on the dividend decision:**

Bond covenants

  - Sell all assets and distribute cash to shareholders!

State laws against excessive dividends

  - Dividends that will make the firm insolvent banned

  - Can pay out of surplus, not out of legal capital

## How Do Companies Determine Dividends?

CFOs believe shareholders want:

1. A share of earnings (Target payout ratio)
2. Steady progression of \$ dividends (Dividend smoothing)

**Lintner's model:**

$$\begin{aligned}D_t &= D_{t-1} + a (T E_t - D_{t-1}) \\ &= a T E_t + (1-a) D_{t-1} \\ &= a T E_t + (1-a) a T E_{t-1} + (1-a)^2 a T E_{t-2} + \dots\end{aligned}$$

**Empirical estimate:**  $T = .5$ ,  $a = .33$

## THE DIVIDEND POLICY CONTROVERSY

**Does dividend policy affect firm value?**

**Dividend Policy = f (Investment policy, Debt policy)**

**CF identity: Optg. CF + CF<sub>Stock issue</sub> + CF<sub>Debt issue</sub> = Inv. exp. + Cash div.**

**S = (?) f (Δ Cash Div. | Inv. decision, Borrowing Decision)**

**i.e., Does an ↑ Cash div. via an equity issue ↑ S?**

**Traditional 'bird in hand' argument (Graham and Dodd)**

## **Modigliani-Miller (MM) Irrelevance Proposition**

In perfect capital markets, given inv. and borrowing policy, dividend policy does not matter.

‘Home-made’ dividends

### **Three Positions on Dividend Policy (with market imperfections)**

#### **1. Dividends increase firm value**

- a. Large clientele for high payout
- b. Dividends signal earnings info.

#### **2. Dividends decrease firm value**

If dividends taxed at higher rate than capital gains

#### **3. Dividends do not affect firm value**

Firms adjust the supply of dividends to match demand

## **17 & 18: CAPITAL STRUCTURE DECISION**

**What is the optimal mix of debt and equity for a firm?**

**Does it affect firm value?**

### **Effect of Capital Structure Choice on Firm Value (Without Taxes)**

**Definition:** Firms with a similar degree of business risk ( $\sigma_{\text{EBIT}}$ ) are said to be in the same risk-class.

**Assumptions:**

- 1. Stocks and bonds are traded in perfectly competitive capital markets (Large number of traders; No taxes or transaction costs; Equal, costless access to info).**
- 2. All investors agree about the E and  $\sigma$  of corporate earnings (EBIT).**
- 3. Firms and individuals can both borrow or lend at risk-free rate ( $r_f$ ).**
- 4. All CFs are perpetuities (i.e., growth rate of the firm is zero; bond is perpetual).**



**MM I:  $V_L = V_U = \text{EBIT}/k_{SU}$**

**Arbitrage Proof (Numerical):**

**Consider two identical firms, L and U, of which L is levered.**

**Both firms have  $E(\text{EBIT}) = \$0.9 \text{ m.}$ , have the same  $\sigma_{\text{EBIT}}$ .**

**L has \$4 m. of debt at  $k_d = r_f = 7.5\%$ .**

**Suppose  $k_{SU} = 10\%$ .**

**Then MM I:  $V_L = V_U = .9/.1 = \$9 \text{ m.}$**

**Suppose not. Say,  $V_L = \$10 \text{ m.}$ , of which  $D_L = \$4 \text{ m.}$ ,  $S_L = \$6 \text{ m.}$**

**Then arbitrage as follows:**

**Suppose you hold 10% of  $S_L$ .**

**Investment value = \$0.6 m.**

**Annual investment income =  $.1 (900,000 - 300,000) = \$60,000$**

**Alternate investment:**

	<b>Annual income</b>
<b>Buy 10% of U's equity at \$900,000</b>	<b>\$90,000</b>
<b><u>Borrow \$400,000 at 7.5%</u></b>	<b><u>-\$30,000</u></b>
<b>Investment cost = \$500,000</b>	<b>\$60,000</b>

**Same income, same risk, but lower cost**

**Home-made leverage.**

**→ VL ↓ to VU.**

**MM II:  $k_{SL} = k_{SU} + (k_{SU} - k_D) D/S$**

**$WACC = k_{AL} = (D/V) k_D + (S/V) k_{SL} = k_U$**

**Ex. Ms. Kraft owns 50,000 shares of the common stock of Copperhead Corporation with a market value of \$2 per share, or \$100,000 overall. The company is currently financed as follows:**

	<b>Book Value</b>
<b>Common stock (8 million shares)</b>	<b>\$2 million</b>
<b>Short-term loans</b>	<b>\$2 million</b>

**Copperhead now announces that it is replacing \$1 million of short-term debt with an issue of common stock. What action can Ms. Kraft take to ensure that she is entitled to exactly the same proportion of profits as before?**

**Ex. The common stock and debt of Northern Sludge are valued at \$50 million and \$30 million, respectively. Investors currently require a 16% return on the common stock and an 8% return on the debt. If Northern Sludge issues an additional \$10 million of common stock and uses this money to retire debt, what happens to the expected return on the stock? Assume that the change in capital structure does not affect the risk of the debt and that there are no taxes.**

**Ex. Spam Corp. is financed entirely by common stock and has a beta of 1.0. The firm is expected to generate a level, perpetual stream of earnings and dividends. The stock has a price–earnings ratio of 8 and a cost of equity of 12.5%. The company’s stock is selling for \$50. Now the firm decides to repurchase half of its shares and substitute an equal value of debt. The debt is risk-free, with a 5% interest rate. The company is exempt from corporate income taxes. Assuming MM are correct, calculate the following items after the refinancing:**

- a. The cost of equity.**
- b. The overall cost of capital (WACC).**
- c. The price–earnings ratio.**
- d. The stock price.**
- e. The stock’s beta.**

## Effect of Capital Structure Choice on Firm Value (With Corporate Tax)

**MM I:**  $V_U = \text{EBIT} (1-T) / k_{SU}$

$$V_L = V_U + \text{pv}(\text{Tax shield})$$

$$= V_U + \sum_{t=1}^{\infty} Tk_d D / (1+k_d)^t$$

$$= V_U + Tk_d D / k_d$$

$$= V_U + TD$$

**Ex. Compute the present value of interest tax shields generated by these three debt issues. The marginal corporate tax rate is 35%.**

**a. A \$1,000, one-year loan at 8%.**

**b. A five-year loan of \$1,000 at 8%. Assume no principal is repaid until maturity.**

**c. A \$1,000 perpetuity at 7%.**

**Ex. Here are book and market value balance sheets of the United Frypan Company (UF):**

Book			Market				
Net working capital	\$20	\$40	Debt	Net working capi	\$20	\$40	Debt
Long-term assets	<u>80</u>	<u>60</u>	Equity	Long-term asset	<u>140</u>	<u>120</u>	Equity
	\$100	\$100			\$160	\$160	

**Assume that MM's theory holds with taxes. There is no growth, and the \$40 of debt is expected to be permanent. Assume a 40% corporate tax rate.**

**a. How much of the firm's value is accounted for by the debt-generated tax shield?**

**b. How much better off will UF's shareholders be if the firm borrows \$20 more and uses it to repurchase stock?**

**MM II:  $k_{SL} = k_{SU} + (k_{SU} - k_D) (D/S) (1-T)$**

$$\begin{aligned} \text{WACC} = k_{AL} &= (D/V)k_D(1-T) + (S/V)k_{SL} \\ &= k_{SU} [1 - T (D/V)] \end{aligned}$$

### **Problems with MM Models**

- **Personal Leverage May Not Substitute Corp. Leverage**
- **Transaction Costs May Hinder Arbitrage**
- **Most institutional investors can't borrow to buy stock**
- **Personal Taxes Can Have Important Effects**
- **$k_D$  may  $\uparrow$  as  $D/S \uparrow^S$**



Ex. 1. Gaucho Services starts life with all-equity financing and a cost of equity of 14%. Suppose it refinances to the following market-value capital structure:

Debt ( $D$ )            45% at  $rD = 9.5\%$

Equity ( $E$ )            55%

Use MM's proposition 2 to calculate the new cost of equity. Gaucho pays taxes at a marginal rate of  $T = 40\%$ . Calculate Gaucho's after-tax weighted-average cost of capital.

Ex. 2. Companies A and B differ only in their capital structure. A is financed 30% debt and 70% equity; B is financed 10% debt and 90% equity. The debt of both companies is risk-free.

a. Rosencrantz owns 1% of the common stock of A. What other investment package would produce identical cash flows for Rosencrantz?

b. Guildenstern owns 2% of the common stock of B. What other investment package would produce identical cash flows for Guildenstern?

c. Show that neither Rosencrantz nor Guildenstern would invest in the common stock of B if the *total* value of company A were less than that of B.

Ex. 3. Executive Chalk is financed solely by common stock and has outstanding 25 million shares with a market price of \$10 a share. It now announces that it intends to issue \$160 million of debt and to use the proceeds to buy back common stock.

a. How is the market price of the stock affected by the announcement?

b. How many shares can the company buy back with the \$160 million of new debt that it issues?

c. What is the market value of the firm (equity plus debt) after the change in capital structure?

d. What is the debt ratio after the change in structure?

e. Who (if anyone) gains or loses?

## Capital Structure Choice with Corporate and Personal Taxes

Let  $T$  = Corporate tax rate

$T_p$  = Personal tax rate on income from bonds (i.e., interest)

$T_{pE}$  = Personal tax rate on income from stock (i.e., dividends, capital gains)

Operating income (EBIT) = \$1, paid out to either bondholders or shareholders

After-tax income to bondholders =  $1 - T_p$

After-tax income to shareholders =  $(1-T) (1- T_{pE})$

Net tax advantage of debt,  $T^* = (1-T_p) - (1-T) (1- T_{pE})$

Ex. Calculate the net tax advantage of debt, if

a.  $T = T_p = .35$ , and  $T_{pE} = .125$

b.  $T = T_p = .35$ , and  $T_{pE} = .105$

**Ex. What is the net tax advantage of corporate debt if the corporate tax rate is  $T = .35$ , the personal tax rate is  $T_p = .35$ , but all equity income is received as capital gains and escapes tax entirely (i.e.,  $T_{pE} = 0$ )? How does the net tax advantage change if the company decides to pay out all equity income as cash dividends that are taxed at 15%?**

**Ex. Suppose that, in an effort to reduce the federal deficit, Congress increases the top personal tax rate on interest and dividends to 35% but retains a 15% tax rate on realized capital gains. The corporate tax rate stays at 35%. Compute the total corporate plus personal taxes paid on debt versus equity income if (a) all capital gains are realized immediately and (b) capital gains are deferred forever. Assume capital gains are one-half of equity income.**

## Relaxing the MM Assumptions

**Risky debt: MM holds if Bankruptcy costs=0**

**Risky debt and bankruptcy costs: Conclusions change**

### Bankruptcy Costs

**Loss in value due to:**

- **Distress sale of assets**
- **Delay in sale of assets**
- **Short-term oriented decisions**
- **Lost business**

**Lawyers' fees, court costs, admin. exp., managers' time**

### How Do Bankruptcy Costs Affect Capital Structure Decision?

**As  $D/S \uparrow^s$ ,  $p(\text{Bankruptcy}) \uparrow^s$**

**If  $BC > 0$ ,  $pV(BC) \uparrow^s$ ,  $\therefore k_d \uparrow^s$**

## **Overall Effect of Capital Structure on Firm Value**

$$V_L = V_U + G_L^{\text{Tax}} - \text{pv}(\text{BC})$$

### **Practical Considerations in Choosing Capital Structure**

- **Taxes**
- **Business risk**
- **Valuable growth opportunities**
- **Control of the firm**
- **Financial flexibility**

### **A Practical Approach to Choosing Capital Structure**

- **Start with industry-average D/V**
- **Adjust based on special considerations for your firm**

## 19: INVESTMENT-FINANCING INTERACTIONS

### Adjusted Present Value (APV) Approach to Capital Budgeting

**Decision Rule: Accept the project if  $APV > 0$ ,**

**$APV = NPV$  of equity financed project +  $NPV$  of financing decisions due to project acceptance**

**Typically,  $NPV$  of financing decisions =  $PV$  (Interest tax shield) - Issue costs**

**Ex. A project costs \$1 million and has a base-case  $NPV$  of zero. What is the project's  $APV$  in the following cases?**

**a. If the firm invests, it has to raise \$500,000 by a stock issue. Issue costs are 15% of *net* proceeds.**

**b. If the firm invests, its debt capacity increases by \$500,000. The present value of interest tax shields on this debt is \$76,000.**

**Ex. Consider a project lasting one year only. The initial outlay is \$1,000 and the expected inflow in year 1 is \$1,200. The opportunity cost of capital is  $r = .20$ . The borrowing rate is  $r_D = .10$ , and the tax shield per dollar of interest is  $T_c = .35$ .**

**a. What is the project's base-case NPV?**

**b. What is its APV if the firm borrows 30% of the project's required investment?**



## **31: MERGERS**

### **Methods of Acquiring Corporate Control**

- **Mergers**
- **Tender-offers**
- **Proxy contests**
- **Leveraged (or Management) Buyouts (LBO or MBO)**

### **Types of Acquisitions (Mergers or Tender-Offers)**

- **Vertical**
- **Horizontal**
- **Conglomerate**

## **Financing of Acquisitions**

- **Cash**
- **Equity**
- **Debt**
- **Combination**

## **Anti-trust Law**

**Clayton Act, 1914: Prohibits acquisitions that substantially reduce competition or tend to create a monopoly in a line of business or part of the country.**

**Enforced by: FTC or DOJ**

**Foreign laws: MNCs**

**Divestitures**

**Economic nationalism**

## Merger Accounting

Purchase of assets: 2001 -

Ex. Here are the balance sheets of two companies.

### Company A (\$m.)

Assets	Liabilities
Assets 10	Debt 3
	Equity 7

### Company B (\$m.)

Assets	Liabilities
Assets 5	Debt 2
	Equity 3

Suppose A buys B; it pays \$4 million for B's equity. What will the balance sheet of the merged company (AB) look like if the fair market value of B's assets is:

- a. \$5 m.
- b. \$6 m.

## **Taxation of Mergers**

**Cash payment:**

**Taxable**

**Stock payment (largely):**

**Tax-free**

**Taxable merger:**

**Target stockholders:**

**Stock sale**

**Acquiring firm:**

**Revaluation of target assets to FMV**

**Affects depreciation**

## **Economics of a Merger (for the acquiring firm)**

$$\text{GAIN} = \text{PV}_{\text{AB}} - (\text{PV}_{\text{A}} + \text{PV}_{\text{B}})$$

$$\text{COST} = \text{CASH} - \text{PV}_{\text{B}}, \text{ if paid by cash}$$

$$\text{COST} = x \text{PV}_{\text{AB}} - \text{PV}_{\text{B}}, \text{ if paid by stock}$$

where  $x$  = proportion of AB's equity owned by  
B's shareholders after the merger

**Ex. As Treasurer of Leisure Products, Inc., you are investigating the possible acquisition of Plastitoys. You have the following basic data:**

	<b>Leisure Products</b>	<b>Plastitoys</b>
<b>Earnings per share</b>	<b>\$ 5.00</b>	<b>\$ 1.50</b>
<b>Dividend per share</b>	<b>\$ 3.00</b>	<b>\$ .80</b>
<b>Number of shares</b>	<b>1,000,000</b>	<b>600,000</b>
<b>Stock price</b>	<b>\$90</b>	<b>\$20</b>

**You estimate that investors currently expect a steady growth of about 6% in Plastitoys' earnings and dividends. Under new management this growth rate would increase to 8% per year, without any additional capital investment.**

- a. What is the gain from the acquisition?**
  
  
  
  
  
  
  
  
  
  
- b. What is the cost of the acquisition if Leisure Products pays \$25 in cash for each share of Plastitoys?**
  
  
  
  
  
  
  
  
  
  
- c. What is the cost of the acquisition if Leisure Products offers one share of Leisure Products for every three shares of Plastitoys?**
  
  
  
  
  
  
  
  
  
  
- d. How would the cost of the cash offer and the share offer change if the expected growth rate of Plastitoys remains unchanged by the merger?**

## **Motives for Acquisitions**

- **Sensible motives**
  - **Scale economies**
  - **Vertical integration**
  - **Operating efficiencies**
  - **Tax savings**
- **Dubious reasons**
  - **Diversification**
  - **To boost eps**
  - **To lower financing cost**

**Ex. World Enterprises wants to increase its earnings per share. So it acquires Wheelrim and Axle Company. There are no gains from the merger. In exchange for W&A shares, WE issues just enough of its own shares to ensure its \$2.67 eps objective. You are given the following facts:**

	<b>WE</b>	<b>W&amp;A</b>	<b>Merged firm</b>
<b>Earnings per share</b>	<b>\$2.00</b>	<b>\$2.50</b>	<b>\$2.67</b>
<b>Price per share</b>	<b>\$40</b>	<b>\$25</b>	<b>?</b>
<b>Price–earnings ratio</b>	<b>20</b>	<b>10</b>	<b>?</b>
<b>Number of shares</b>	<b>100,000</b>	<b>200,000</b>	<b>?</b>
<b>Total earnings</b>	<b>\$200,000</b>	<b>\$500,000</b>	<b>?</b>
<b>Total market value</b>	<b>\$4,000,000</b>	<b>\$5,000,000</b>	<b>?</b>

**a. Complete the table for the merged firm.**



**b. How many shares of WE are exchanged for each share of W&A?**

**c. What is the cost of the merger to World Enterprises?**

**d. What is the change in the total market value of the WE shares that were outstanding before the merger?**

## **Profitability of acquisitions to shareholders**

	<b>Acquiring firm</b>	<b>Acquired firm</b>
<b>Mergers</b>	<b>0%</b>	<b>20%</b>
<b>Tender-offers</b>	<b>2</b>	<b>30</b>

## **Recent merger waves**

**1967-69**

**1981-86**

**1996 - 2000**

**2003 - 2007**

## **Aspects of Merger Negotiation**

### **Takeover defenses**

- **Charter amendments**
- **Poison pills**
- **Dual class recaps**

### **Greenmail**

### **Standstill agreements**

### **Golden parachutes**

### **White knight mergers**

## 20: OPTION VALUATION

### WHY IS THE FINANCE MANAGER OF A COMPANY INTERESTED IN IT?

#### Managers

- Routinely use options on
- Purchase insurance
- Make investment and financing decisions with options embedded

### STOCK OPTIONS

**Definition:** *Right to buy or sell a stock at a fixed exercise price on or before a fixed maturity date.*

Types            Call

                  Put

Terminology

Option    European  
            American

Option    In the money  
            At the money  
            Out of the money

**Option premium   Intrinsic Value**  
**Time Value**

**Trading Strategies**

## **OPTION VALUATION**

**Why won't the DCF method work?**

**Valuation by replication**

**Risk-neutral valuation**

**Determinants of call option value**

**Black-Scholes Model**

**Put-call parity**

## **21 PRACTICAL CORPORATE INVESTMENT PROBLEMS INVOLVING OPTIONS**

### **1. OPTION TO ABANDON**

### **2. TIMING OF INVESTMENT**

### **3. FOLLOW-ON INVESTMENT OPPORTUNITY**

**EX. Your company is thinking of buying a new airline. There is a 60% chance that the business will get off to a good start in one year. If so, the business will be worth \$736,000 at that time; if not, it will be worth \$182,000. The cost of capital is 10% and the riskfree rate is 5%.**

- a. What is the PV of the business?**
- b. If you have an option to sell the business for \$300,000 after one year, what is the PV of the business with this option?**

### **4. VALUE OF FLEXIBILITY**