

## Chapter 7 -- Stocks and Stock Valuation

- Characteristics of common stock
  - The market price vs. intrinsic value
  - Stock market reporting
  - Stock valuation models
  - Valuing a corporation
  - Preferred stock
  - The efficient market hypothesis (EMH)
- 
- Characteristics of common stock
    - Ownership in a corporation: control of the firm
  
    - Claim on income: residual claim on income
    - Claim on assets: residual claim on assets
  
    - Commonly used terms: voting rights, proxy, proxy fight, takeover, preemptive rights, classified stock, and limited liability
- 
- The market price vs. intrinsic value
    - Intrinsic value is an estimate of a stock's "fair" value (how much a stock should be worth)
  
    - Market price is the actual price of a stock, which is determined by the demand and supply of the stock in the market
  
    - Figure 7-1: Determinants of Intrinsic Values and Market Prices
  
    - Intrinsic value is supposed to be estimated using the "true" or accurate risk and return data. However, since sometimes the "true" or accurate data is not directly observable, the intrinsic value cannot be measured precisely.
  
    - Market value is based on perceived risk and return data. Since the perceived risk and return may not be equal to the "true" risk and return, the market value can be mispriced as well.
  
    - Stock in equilibrium: when a stock's market price is equal to its intrinsic value the stock is in equilibrium
  
    - Stock market in equilibrium: when all the stocks in the market are in equilibrium (i.e. for each stock in the market, the market price is equal to its intrinsic value) then the market is in equilibrium

- Stock market reporting
  - Provide up-to-date trading information for different stocks

Figure 7-2: Stock Quote and Other Data for GE

Stock Symbol (GE)

Prev close: closing price on Feb. 13, 2009 was \$11.68

Change: change from the last trading price and the previous day closing price is  
 $-\$0.24 = \$11.68 - \$11.44$

Volume: trading volume for the day is 85,594,997 shares

Avg Vol (3m): average daily trading volume over the past 3 months is  
 119,828,000 shares

52 wk Range: range of the highest and lowest prices for GE in the past 52 weeks  
 (\$10.66 - \$38.52)

Day's Range: range of the highest and lowest prices for GE for the day  
 (\$11.35 - \$11.74)

Div & Yield: annual dividend and dividend yield (\$1.24 is the annual dividend, or  
 \$0.31 per share last quarter) and dividend yield is 10.80% ( $1.24/11.44 = 10.80\%$ )

P/E (ttm): price to earnings (in the past 12 months) ratio is 6.66 ( $11.44/1.72$ )

- Common stock valuation
  - Stock price vs. intrinsic value: a revisit

Growth rate  $g$ : expected rate of growth in dividends

$g = \text{ROE} * \text{retention ratio}$

Retention ratio = 1 - dividend payout ratio

The growth rate ( $g$ ) plays an important role in stock valuation

The general dividend discount model:  $\hat{P}_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r_s)^t}$

Rationale: estimate the intrinsic value for the stock and compare it with the market price to determine if the stock in the market is over-priced or under-priced

(1) Zero growth model (the dividend growth rate,  $g = 0$ )

It is a perpetuity model:  $\hat{P}_0 = \frac{D}{r_s}$

For example, if  $D = \$2.00$  and  $r_s = 10\%$ , then  $\hat{P}_0 = \$20$

If the market price ( $P_0$ ) is \$22, what should you do?

You should not buy it because the stock is over-priced

(2) Constant growth model (the dividend growth rate,  $g = \text{constant}$ )

$$\hat{P}_0 = \frac{D_1}{r_s - g} = \frac{D_0 * (1 + g)}{r_s - g}$$

For example, if  $D_0 = \$2.00$ ,  $g = 5\%$ ,  $r_s = 10\%$ , then  $\hat{P}_0 = \frac{2 * (1 + 5\%)}{0.10 - 0.05} = \$42$

If the market price ( $P_0$ ) is \$40, what should you do?

You should buy it because the stock is under-priced

Common stock valuation: estimate the expected rate of return given the market price for a constant growth stock

Expected return = expected dividend yield + expected capital gains yield

$$\hat{r}_s = \frac{D_1}{P_0} + g = \frac{D_0 * (1 + g)}{P_0} + g$$

In the above example,

$$\hat{r}_s = \frac{D_0 * (1 + g)}{P_0} + g = \frac{2.00 * (1 + 0.05)}{40} + 0.05 = 0.0525 + 0.05 = 10.25\%$$

where 5.25% is the expected dividend yield and 5% is the expected capital gains yield (stock price will increase by 5% per year)

What would be the expected dividend yield and capital gains yield under the zero growth model?

Expected capital gains yield,  $g = 0$  (price will remain constant)

Expected dividend yield =  $D/P_0$

(3) Non-constant growth model: part of the firm's cycle in which it grows much faster for the first  $N$  years and gradually return to a constant growth rate

Apply the constant growth model at the end of year  $N$  and then discount all expected future cash flows to the present

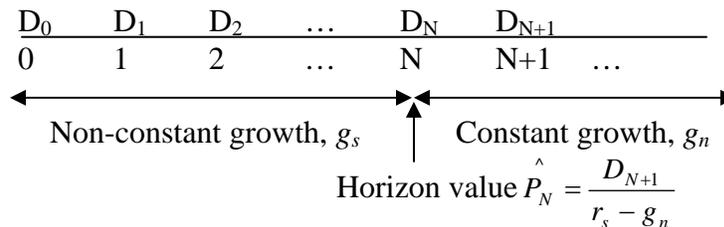


Figure 7-5: Non-Constant Growth Stock

Example: if  $N = 3$ ,  $g_s = 30\%$ ,  $g_n = 8\%$ ,  $D_0 = \$1.15$ , and  $r_s = 13.4\%$ , then

$D_4 = 2.7287$ ,  $\hat{P}_3 = 53.5310$ , and  $\hat{P}_0 = 39.2134$

- Valuing a corporation  
It is similar to valuing a stock (using expected FCF instead of expected dividends)

$V$  = present value of expected future free cash flows

$FCF = EBIT \cdot (1 - T) + \text{depreciation and amortization} - (\text{capital expenditures} + \Delta \text{ in net working capital})$

The discount rate should be the WACC (weighted average cost of capital)

- Preferred stock  
A hybrid security because it has both common stock and bond features

Claim on assets and income: has priority over common stocks but after bonds

Cumulative feature: all past unpaid dividends should be paid before any dividend can be paid to common stock shareholders

Valuation of preferred stock

Intrinsic value =  $V_p = D_p / r_p$       and      Expected return =  $\hat{r}_p = \frac{D_p}{P_p}$

Example: if a preferred stock pays \$2 per share annual dividend and has a required rate of return of 10%, then the fair value of the stock should be \$20

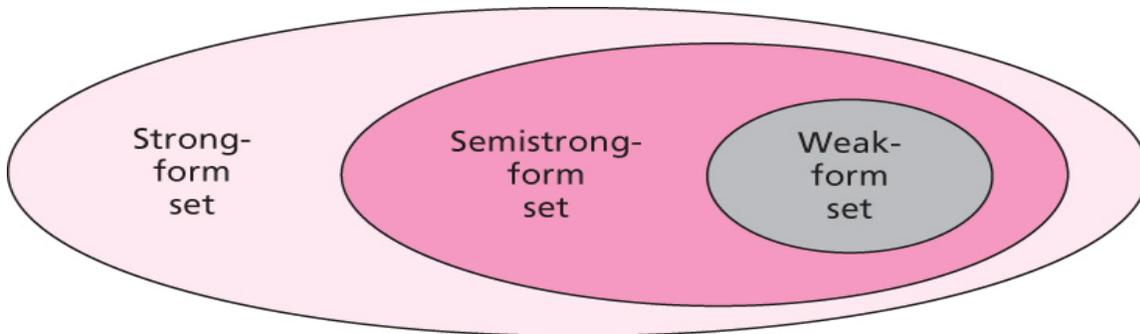
- The efficient market hypothesis (EMH)  
Efficient market: prices of securities in the market should fully and quickly reflect all available information, which means that market prices should be close to intrinsic values (market in equilibrium)

Levels of market efficiency

Weak-form efficiency - stock prices already reflect all information contained in the history of past price movements (only past trading information, including past prices, volumes, and returns)

Semistrong-form efficiency - stock prices already reflect all publicly available information in the market (only past publicly available information)

Strong-form efficiency - stock prices already reflect all available information in the market, including inside information (all publicly and privately available information)



Where is the market today?

Less efficient	→	More efficient
Small firms with less coverage and contact		Large firms with more coverage and contact

• **Exercises**

Read Summary  
 ST-1 and ST-2  
 Problems: 3, 5, 9, 11, and 17

Example: investors expect a company to announce a 10% increase in earnings; instead, the company announces a 3% increase. If the market is semi-strong form efficient, which of the following would you expect to happen? (b)

- a. The stock's price will increase slightly because the company had a slight increase in earnings.
- b. The stock's price will fall because the increase in earnings was less than expected.
- c. The stock's price will stay the same because earnings announcements have no effect if the market is semi-strong form efficient.

Problem 7: given  $D_1 = \$2.00$ ,  $\beta = 0.9$ , risk-free rate = 5.6%, market risk premium = 6%, current stock price = \$25, and the market is in equilibrium

Question: what should be the stock price in 3 years ( $\hat{P}_3$ )?

Answer: required return = expected return = 5.6% + 6%\*0.9 = 11%

Expected dividend yield =  $D_1/P_0 = 2/25 = 8\%$

Expected capital gains yield =  $g = 11\% - 8\% = 3\%$

Expected stock price after 3 years  $\hat{P}_3 = 25*(1+3\%)^3 = \$27.32$

Or  $D_4 = D_1*(1+g)^3 = 2*(1+3\%)^3 = \$2.1855$  and then apply the constant growth

model  $\hat{P}_3 = \frac{D_4}{r_s - g} = \frac{2.1855}{0.11 - 0.03} = \$27.32$

## Chapter 9 -- Cost of Capital

- Capital components
  - Cost of debt before and after tax
  - Cost of preferred stock
  - Cost of retained earnings
  - Cost of new common stock
  - Weighted average cost of capital (WACC)
  - Factors that affect WACC
  - Adjusting the cost of capital for risk
- 
- Capital components
    - Debt: debt financing
    - Preferred stock: preferred stock financing
    - Equity: equity financing (internal vs. external)
    - Internal: retained earnings
    - External: new common stock
    - Weighted average cost of capital (WACC)

- Cost of debt before and after tax
  - Recall the bond valuation formula
  - Replace  $V_B$  by the net price of the bond and solve for I/YR
  - $I/YR = r_d$  (cost of debt before tax)

Net price = market price - flotation cost

If we ignore flotation costs which are generally small, we can just use the actual market price to calculate  $r_d$

Cost of debt after tax = cost of debt before tax  $(1-T) = r_d (1-T)$

Example: a firm can issue a 10-year 8% coupon bond with a face value of \$1,000 to raise money. The firm pays interest semiannually. The net price for each bond is \$950. What is the cost of debt before tax? If the firm's marginal tax rate is 40%, what is the cost of debt after tax?

Answer:  $PMT = -40$ ,  $FV = -1,000$ ,  $N = 20$ ,  $PV = 950$ , solve for  $I/YR = 4.38\%$   
Cost of debt before tax =  $r_d = 8.76\%$

Cost of debt after tax =  $r_d*(1-T) = 8.76*(1-0.4) = 5.26\%$

- Cost of preferred stock  
Recall the preferred stock valuation formula  
Replace  $V_p$  by the net price and solve for  $r_p$  (cost of preferred stock)

Net price = market price - flotation cost

If we ignore flotation costs, we can just use the actual market price to calculate  $r_p$

$$r_p = \frac{D_{Ps}}{P_{Ps}(1-F)}$$

Example: a firm can issue preferred stock to raise money. The market price for one share of the firm's preferred stock is \$50 but flotation cost is 2% (or \$1 per share). The firm will pay \$4.00 dividend every year to preferred stock holders. What is the cost of preferred stock?

Answer:  $4/49 = 8.16\%$  (net price is \$49)

- Cost of retained earnings  
CAPM approach

$$r_i = r_{RF} + (r_M - r_{RF})\beta_i$$

DCF approach

$$r_s = \frac{D_1}{P_0} + g = \frac{D_0(1+g)}{P_0} + g$$

Bond yield plus risk premium approach

$$r_s = \text{bond yield} + \text{risk premium (risk premium is usually between 3-5\%)}$$

When must a firm use external equity financing?

R/E

Retained earning breakpoint = -----  
% of equity

It is the dollar amount of capital beyond which new common stock must be issued

For example, suppose the target capital structure for XYZ is 40% debt, 10% preferred stock, and 50% equity. If the firm's net income is \$5,000,000 and the dividend payout ratio is 40% (i.e., the firm pays out \$2,000,000 as cash dividend and retains \$3,000,000), then the retained earning breakpoint will be

$$\frac{3,000,000}{50\%} = \$6,000,000$$

If XYZ needs to raise more than \$6,000,000, it must issue new common stock.

- Cost of new common stock

$$r_e = \frac{D_1}{P_0(1-F)} + g = \frac{D_0(1+g)}{P_0(1-F)} + g, \text{ where } F \text{ is the flotation cost}$$

- Weighted average cost of capital (WACC)

Target capital structure: the percentages (weights) of debt, preferred stock, and common equity that will maximize the firm's stock price

$$\text{WACC} = w_d r_d (1-T) + w_p r_p + w_c (r_s \text{ or } r_e)$$

#### Comprehensive example

Rollins Corporation is constructing its MCC schedule. Its target capital structure is 20% debt, 20% preferred stock, and 60% common equity. Its bonds have a 12% coupon, paid semiannually, a current maturity of 20 years, and a net price of \$960. The firm could sell, at par, \$100 preferred stock that pays a \$10 annual dividend, but flotation costs of 5% would be incurred. Rollins' beta is 1.5, the risk-free rate is 4%, and the market return is 12%. Rollins is a constant growth firm which just paid a dividend of \$2.00, sells for \$27.00 per share, and has a growth rate of 8%. Flotation cost on new common stock is 6%, and the firm's marginal tax rate is 40%.

- a) What is Rollins' component cost of debt before and after tax?

Answer: Cost of debt before tax = 12.55%  
Cost of debt after tax = 7.53%

- b) What is Rollins' cost of preferred stock?

Answer: Cost of P/S = 10.53%

- c) What is Rollins' cost of R/E using the CAPM approach?

Answer: Cost of R/E = 16%

- d) What is the firm's cost of R/E using the DCF approach?

Answer: Cost of R/E = 16%

- e) What is Rollins WACC if it uses debt, preferred stock, and R/E to raise money?

Answer: WACC (R/E) = 13.21%

- f) What is Rollins' WACC once it starts using new common stock financing?

Answer: Cost of N/C = 16.51%  
WACC (N/C) = 13.52%

- **Factors that affect WACC**
  - Factors out of a firm's control
    - The state of the financial markets
    - Risk premium
    - Tax rates
  - Factors that a firm can control
    - Capital structure
    - Dividend policy
    - Investment policy
  
- **Adjusting the cost of capital for risk**
  - Divisional costs of capital
  
  - The pure play method
  
  - 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
  
- **Exercise**
  - Read Summary
  - ST-1
  - Problems: 5, 6, 7, 11, and 15

## Chapters 10&11 -- Capital Budgeting

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

- Capital budgeting

Capital budgeting: the process of analyzing and deciding what projects (assets) should be included in capital budget

Capital budget: a plan that outlines projected expenditures during a future period

- 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 10)

(1) Net present value (NPV): present value of a project's cash inflows minus the present value of its costs. The discounted rate is the project cost of capital.

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

(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) Profitability index (PI): present value of future cash flows divided by the initial cost

(5) Payback period: the length of time (years) required for a project's cash flows to recover its cost

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

Example: basic data for projects L and S

Year	Project S	Project L
0	-\$10,000	-\$10,000
1	5,000	1,000
2	4,000	3,000
3	3,000	4,000
4	1,000	6,750

The cost of capital for each project is 10%. Which project is a better project?

Figure 10-1: Cash Flows and Selected Evaluation Criteria for Project S and L

(1) NPV approach

Figure 10-2: Finding NPV

TI BAI plus or TI BAI plus professional (CF function)

Press "CF" first, then press "2<sup>nd</sup>", followed by pressing "CLR WORK"

$CF_0 = -10,000$ , press "enter" and "↓"; then  $C0_1 = 5,000$ , press "enter" and "↓";  
 $F0_1 = 1$ , press "↓"; repeat the same procedure to enter  $C0_2 = 4,000$ ,  $C0_3 = 3,000$ ,  
and  $C0_4 = 1,000$ ; 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);  
 $NPV_S = 788.20$

Exercise: check  $NPV_L = 1,004.03$

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  $NPV > 0$  for both projects

(2) IRR approach

Figure 10-3: Finding IRR

TI BAI plus or TI BAI plus professional (CF function)

Press "CF" first, then press "2<sup>nd</sup>", followed by pressing "CLR WORK"

$CF_0 = -10,000$ , press "enter" and "↓"; then  $C0_1 = 5,000$ , press "enter" and "↓";

$F0_1 = 1$ , press "↓"; repeat the same procedure to enter  $C0_2 = 4,000$ ,  $C0_3 = 3,000$ ,

and  $C0_4 = 1,000$ ; press "IRR", you will see  $IRR = 0.0000$ ; press "CPT" (on the up left corner);  $IRR_S = 14.49\%$

Exercise: check  $IRR_L = 13.55\%$

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 or the cost of capital for the project)

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

Figure 10-4: Multiple 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

For most firms, assuming reinvestment at the project's WACC is better than assuming reinvestment at the project's IRR.

### (3) MIRR approach

Step 1: compound each future cash inflow to the “terminal year”, using WACC

Step 2: add all the future values to get “terminal value

Step 3: calculate I/YR to get MIRR

#### Figure 10-5: Finding 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 or cost of capital for the project)

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

#### Figure 10-6: NPV Profile for Project S

When  $r < 14.49\%$ , NPV for S is positive, which means that the project will be accepted

When  $r > 14.49\%$ , NPV for S is negative, which means that the project will be rejected

#### Figure 10-7: NPV Profiles for Projects S and L

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 (11.975%)?

If the cost of capital is less than 11.975%, L is better.

If the cost of capital is greater than 11.975% (but less than 14.49%), S is better.

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).

Main conditions to cause conflicts (ranking problems)

- a. Timing of cash flows
- b. Scale of cash flows

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

#### (4) Profitability Index

##### Figure 10-8: Profitability Index

Decision rule: if  $PI > 1$ , accept project; if  $PI < 1$ , reject the project

Relationship between NPV and PI

If  $NPV > 0$  then  $PI > 1$ ; If  $NPV < 0$  then  $PI < 1$ ; If  $NPV = 0$  then  $PI = 1$

#### (5) Payback period approach

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

##### Figure 10-9: Payback Period

Decision rule:

If  $\text{payback} < \text{maximum payback}$ , then accept the project

If  $\text{payback} > \text{maximum payback}$ , then reject the project

Weaknesses:

Arbitrary maximum payback

Ignores time value of money

Ignores cash flows after maximum payback period

#### (6) Discounted payback period approach

Step 1: discount future cash flows to the present at the cost of capital

Step 2: follow the steps similar to payback period approach

##### Figure 10-10: Discounted Payback Period

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 10-1: Capital Budgeting methods Used in Practice

NPV and IRR are the most popular methods used by firms these days, followed by payback and then discounted payback.

Projects with unequal lives

Replacement chain (common life) method: analyze projects over an equal life

Equivalent annual annuity (EAA) method: convert NPV into a constant annual annuity

Figure 10-11: Analysis of Projects with Unequal Lives

- Optimal capital budget

The annual investment in long-term assets (a set of projects) that maximizes the firm's value

Increasing marginal cost of capital: the marginal cost of capital (MCC) increases as the capital budget increases

Decreasing investments opportunity schedule: the marginal return from investments decreases as the capital budget increases

Figure 10-13: IOS and MCC Schedules

When  $IOS = MCC$ , the optimal capital budget is reached.

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 the firm's value.

- Cash flow estimation (Chapter 11)
  - 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)

$$FCF = [EBIT \cdot (1 - T) + \text{depreciation}] - [\text{capital expenditures} + \Delta \text{NOWK}]$$

$$EBIT \cdot (1 - T) = \text{net operating profit after tax} = \text{NOPAT}$$

$$\Delta \text{NOWK} = \text{change in net operating working capital}$$

$$\text{Net cash flow} = \text{NI} + \text{depreciation, if no interest payments}$$

Steps in estimating cash flows

Step 1: initial outlay

Step 2: differential (operating) cash flows over project's life

Step 3: terminal cash flows

Step 4: time line and solve

Example: an expansion project

Figure 11-1: Analysis of an Expansion Project

Figure 11-2: Cash Flow Estimation and Performance Measures (signs are wrong)

Project net cash flows: Time Line    -\$4,207    \$1,048    \$1,296    \$980    \$2171

Since NPV is positive and  $IRR > WACC$ , the expansion should be taken.

Cash flow estimation: a new project (streamline approach)

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%.

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

Net cash flow = after-tax cash flows from operation + depreciation tax-shield

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 =  $11,520 + 12,176 = \$23,696$

d)  $NPV = -\$2,505.60 < 0$ ,  $IRR = 10.84\% < 14\%$

Since  $NPV < 0$  and  $IRR < WACC$ , do not take the project.

Example: a replacement project

- Data for both old and new machines  
Sale revenue is fixed: \$2,500  
Expected life of the old and new machines: 4 years  
WACC: 10%  
Tax rate: 40%
- Data for old machine  
After-tax salvage value today: \$400  
Operating costs per year except depreciation: \$1,200  
Old machine depreciation: \$400 per year (straight-line method)
- Data for new machine  
Cost of new machine: \$2,000 (MACRS 3-year system with depreciation rates of 33%, 45%, 15% and 7%)  
Operating costs per year except depreciation: \$280

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

Figure 11-9: Replacement Analysis (sings and numbers are wrong)

Net cash flows before replacement    \$0    \$940    \$940    \$940    \$940

Streamline approach

$CF_0 = -2,000 + 400 = -1,600$

$CF_1 = (1,200 - 280) * (1 - 0.4) + (660 - 400) * (0.4) = \$656$

$CF_2 = (1,200 - 280) * (1 - 0.4) + (900 - 400) * (0.4) = \$752$

$CF_3 = (1,200 - 280) * (1 - 0.4) + (300 - 400) * (0.4) = \$512$

$CF_4 = (1,200 - 280) * (1 - 0.4) + (140 - 400) * (0.4) = \$448$

$TCF = 0$

$NPV = \$308.51$  and  $IRR = 19.33\%$

Since NPV for the project is positive and IRR for the project  $> WACC$ , the replacement project should be taken.

- 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

Sensitivity analysis: a percentage change in NPV due to a percentage change in one input variable, keeping other input variables constant (at their expected values)

Scenario analysis: allow several input variables to change at a time under different scenarios (best, good, average, below average, worse, and worst cases)

Monte Carlo simulation: assign a probability distribution to each input variable and a computer will pick a random number from the distribution for each input variable. Those values will be entered into the model to calculate the project NPV. The computer will repeat the same procedure for N times to get a distribution for NPV.

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

- **Exercise**

Chapter 10

Read Summary

ST-1

Problems: 8, 9, and 20

Chapter 11

Read Summary

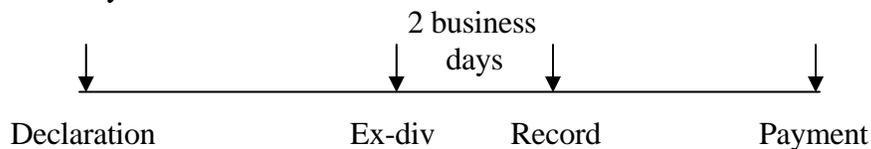
ST-1 and ST-2

Problems: 7 and 9

Group Mini Case: a-i only (Due next week)

## Chapter 14 -- Dividend Policy

- Dividend vs. retained earnings
  - Dividend payment procedures
  - Dividend policy: three basic views
  - The clientele effect
  - The information content or signaling hypothesis
  - Dividend policy in practice
  - 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 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 a stock before its ex-dividend date, you will receive dividend (but you pay a higher price); if you buy a stock on or after ex-dividend date, you will not receive dividend (but you pay a lower price).
- Dividend policy: three basic views
    - Dividend policy: to determine the optimal payout ratio to maximize 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 firm value
    - Rationale: in a perfect world, investors can always create their own payout ratios
    - 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.

Rationale: since we are not living in a perfect world return from cash dividend is less risky than return from capital gains

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 avoided if stocks are passed to beneficiaries provided the original owner passes away.

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

Rationale: to reduce taxes, investors will buy stocks with less dividends and higher growth potential (more capital gains)

- The clientele effect  
People are different and 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 firm now needs to raise \$1,200,000 and has NI = \$450,000

Question: what should be the amount of dividend if the firm adopts the residual dividend policy?

Answer:  $\$1,200,000 \times (0.3) = \$360,000$  should be raised from equity (retained from NI)

Dividend = NI - R/E =  $450,000 - 360,000 = \$90,000$

Question: If the company has 1,000,000 shares outstanding, what is DPS?

Answer:  $\text{DPS} = \$0.09/\text{share}$

Alternatives:

Constant dividend payout ratio

Stable dividend per share

Low regular dividend plus extras when time is good

- 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**

Read Summary

ST-1

Problems: 2, 4\*, 7, 9\*, and 11

Problem 4: a firm has 10 million shares outstanding with a market price of \$20, \$25 million in extra cash to repurchase stocks at \$20 per share, and no debt.

What is the value of operations?  $V_{OP} = 20 * 10 \text{ mil} - 25 \text{ mil} = \$175 \text{ mil}$

How many shares will remain outstanding after repurchase?  $10 - 1.25 = 8.75 \text{ mil}$

Problem 9: a firm has three independent projects and each of them requires \$5 million investment:

Project H (high risk)	Cost of capital = 16%	IRR = 20%
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Project M (medium risk)	Cost of capital = 12%	IRR = 10%
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Project L (low risk)	Cost of capital = 8%	IRR = 9%
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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  $IRR > \text{cost of capital}$  for both H and L, which means that the firm needs to raise \$10 million

According to the optimal capital structure:

$\$10 \text{ million} * (0.5) = \$5 \text{ million}$  will be raised from debt

$\$10 \text{ million} * (0.5) = \$5 \text{ million}$  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 -- Capital Structure

- Capital structure
- Business risk vs. financial risk
- Capital structure theories
- Estimating the optimal capital structure

- 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 value or 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 extent to which fixed income securities are used

Figure 15-2: Operating Leverage and Financial Leverage

Break-even condition:  $EBIT = PQ - VQ - F = 0$

- 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 firm value or 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 vs. 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.

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

Figure 15-4: Effect of Financial Leverage on Firm Value

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.

Reserve borrowing capacity: firms should, in normal times, reserve some room in debt financing (use less debt than the trading-off model depicts).

Pecking order theory: due to flotation costs and asymmetric information, firms should consider using retained earnings and short-term debt to raise money first. If those funds are not available, firms can consider long-term debt and preferred stock financing. Issuing new common stocks to raise money should be the last choice.

- Estimating the optimal capital structure  
WACC and capital structure change

$$\begin{aligned} \text{WACC} &= w_d(r_d)(1-T) + w_e(r_s), \text{ assuming no preferred stock} \\ &= (D/A)*(r_d)*(1-T) + (E/A)*(r_s) \end{aligned}$$

where D/A is the debt-to-assets (debt) ratio, E/A is the equity-to-assets (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)

Figure 15-6: Required rate of return on equity at different debt levels

$$\text{Hamada equation: } \beta_L = \beta_U [1 + (1-T)(D/E)] \text{ or } \beta_U = \beta_L / [1 + (1-T)(D/E)]$$

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

Figure 15-5: Estimating Optimal Capital Structure

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 \$20.79 and WACC is minimized at 11.63%.

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.

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

- **Exercise**

Read Summary

ST-1 and ST-2

Problems: 5, 8, and 9

Problem: 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; WACC is 13.4% (cost of equity,  $r_s$  is 13.4%) and the stock is in equilibrium

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?

Answer:

The current dividend per share,  $D_0 = \$400,000/200,000 = \$2.00$

Since the growth rate is expected to be 5%,  $D_1 = \$2.00(1.05) = \$2.10$

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:

$$\text{EBIT} = \$1,000,000/(1 - T) = \$1,000,000/0.6 = \$1,666,667$$

Note: The firm is 100% equity financed now, 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:

$$200,000 - (\$1,000,000/\$25) = 160,000 \text{ shares}$$

Step 4 Calculate  $D_1$  after the recapitalization:

$$D_0 = 0.4 * (\$934,000/160,000) = \$2.335$$

$$\text{Since the expected growth rate is 5\%, } D_1 = \$2.335(1.05) = \$2.45175$$

Step 5 Calculate  $P_0$  after the recapitalization:

$$P_0 = D_1/(r_s - g) = \$2.45175/(0.145 - 0.05) = \$25.81$$