Chapter 4

Common Stocks

Road Map

Part A Introduction to finance.

Part B Valuation of assets, given discount rates.

- Fixed-Income securities.
- Stocks.
- Real asset (capital budgeting).

Part C Determination of risk-adjusted discount rates.

Part D Introduction to derivatives.

Main Issues

- Introduction to Stock Markets
- Discounted Cash Flow Model (DCF)
- Modelling Cash Flows
- EPS, P/E and Growth Opportunities

1 Motivating Examples

Example 1. Valuing Individual Stocks. How much would you be willing to pay for the stocks of Duke Energy and Anheuser Busch, given the following information?

A. Duke Energy: Supplies electricity to 1.8 million customers in North and South Carolina and supplies approximately 12% of the natural gas consumed in the US. Has 20,000 employees and 130,683 common stockholders. Source: *Value Line.*

B. Anheuser Busch: The world's largest brewer, one of the largest theme park operators in the US, the second-largest US manufacturer of aluminum beverage containers. Significant brands: Budweiser, Michelob, and Busch. Has 24,125 employees and 64,120 shareholders. Source: *Value Line.*

- **Dividend Information**

Company Name	This Year's Dividend	Next Year's Dividend	2-yr Avg Forecasted Dividend growth
Duke Energy	2.20	2.29	4.0%
Anheuser Busch	1.04	1.13	8.4%

- **Information on interest rates and risk premia**

Long-term Interest Rates	6.0%
Market Risk Premium	5.0%

- **Adjustments to Market Premium**

Duke Energy	-1.50%
Anheuser Busch	-0.75%

Example 2. Growth Stocks. Texas Western (TW) is expected to earn \$1.00 next year. Book value per share is \$10.00 now. TW plans an investment program which will increase net book assets by 8% per year. Earnings are expected to grow proportionally. The investment is financed by retained earnings. The discount rate is 10%, which is assumed to be the same as the rate of return on new investments. How much would you be willing to pay for TW if

1. if it expands at 8% forever?
2. if its expansion slows down to 4% after year 5?

2 Introduction to Stock Markets

Definition: Common stock represents *equity*, an ownership position, in a corporation.

- Payments to common stock are dividends:
  - Cash dividend.
  - Stock dividend.
- Contrary to payments to bondholders, payments to stockholders are uncertain in both magnitude and timing.
- Important characteristics of common stock:
  1. Residual claim - stockholders have claim to firm's cash flows/assets *after* all obligations to creditors are met.
  2. Limited liability - stockholders may lose their investments, but no more.
  3. Voting rights - Stockholders are entitled to vote for the board of directors and on other matters.

Organization of Stock Markets

1. Primary market - underwriting
   - Venture capital: A company issues shares to investment partnerships, investment institutions and wealthy individuals.
   - Initial public offering (IPO): A company issues shares to general public for the first time (i.e., going public).
   - Secondary offerings: A public company issues additional shares.

   Stock issuing to the public is usually organized by investment bank who act an underwriters.

2. Secondary market (resale market) - Exchanges and OTC.
   - Exchanges: NYSE, AMEX, ECNs, ...
     - Specialist.
     - Electronic.
   - OTC: NASDAQ.

3. Trading in secondary market.
   - Trading costs: commission, bid-ask spread, price impact.
   - Buy on margin.
   - Long and short.

3 Discounted Cash Flow Model

Basic DCF formula applies to valuation of stocks. Need to know

1. Expected future dividends

2. Discount rates for dividends.

Notation:

P_t: Expected stock price at t (ex-dividend)

D_t: Expected cash dividend at t

r_t: Risk-adjusted discount rate for cash flow at t.

Dividend Discount Model (DCF)

DCF: Stock price is the present value of future dividends.

Applying DCF formula, we have the Dividend Discount Model:

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r_t)^t} = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t}.$$

Additional Assumption: $r_t = r$.

Valuation Based on Finite Holding Period

1. Stock price at $t = 0$:
$$P_0 = \frac{D_1}{1+r} + \frac{P_1}{1+r}.$$

2. What determines P_1?
$$P_1 = \frac{D_2}{1+r} + \frac{P_2}{1+r}.$$

3. Thus,
$$\begin{aligned} P_0 &= \frac{D_1}{1+r} + \frac{1}{1+r}\left(\frac{D_2+P_2}{1+r}\right) \\ &= \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{P_2}{(1+r)^2} \\ &= \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t}. \end{aligned}$$

Observation: DCF does not require holding the stock forever.

Applications of DCF involve further information on

1. Future dividends
2. Discount rates.

We focus on (1) first and return to (2) later (in Part C).

4 Modelling Cash Flows

4.1 DCF with Constant Growth

Suppose that dividends are expected to grow at a constant rate g in perpetuity. That is

$$D_{t+1} = (1+g) \times D_t.$$

Then

$$\begin{aligned} P_0 &= \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t} = \sum_{t=1}^{\infty} \frac{(1+g)^{t-1}}{(1+r)^t} D_1 \\ &= \frac{D_1}{r-g} \qquad \text{if} \quad r > g. \end{aligned}$$

This is the Gordon Model:

$$P_0 = \frac{D_1}{r-g} = \frac{1+g}{r-g} D_0.$$

Example 1. Dividends are expected to grow at 6% per year and the current dividend is \$1 per share. The expected rate of return is 20%. The current stock price should be

$$P_0 = \frac{1.06}{0.20 - 0.06} \times 1 = \$7.57.$$

- DCF with constant growth gives a relation between current stock price, current dividend, dividend growth rate and the expected return. Knowing three of the variables, we can determine the fourth.

Example. Determine cost of equity (the discount rate). In 09/92, the dividend yield for Duke Power was $D_0/P_0 = 0.052$. Estimates of long-run growth:

Info Source	Value Line (VL)	I/B/E/S
Growth g	0.049	0.041

The cost of capital is given by

$$r = (1+g)(D_0/P_0) + g.$$

Thus,

	Cost of Capital
VL	$r = (0.052)(1.049) + 0.049 = 10.35\%$
IBES	$r = (0.052)(1.041) + 0.041 = 9.51\%$

Example. Estimate dividend growth rate. WSJ reported the following data on AT&T stock:

AT&T	DIV	YLD	P/E	High	Low	Last	Chg
	1.32	3.4	60	38.5	38.125	38.5	+.25

Question. What is the market's estimate of dividend growth rate, if $r = 12\%$?

Solving the valuation formula for g gives

$$g = \frac{r - D_0/P_0}{1 + D_0/P_0}.$$

Since

$$P_0 = (38.5 + 38.125)/2 = 38.3125$$

$$D_0/P_0 = 1.32/38.3125 = 0.03445$$

We have

$$g = \frac{0.12 - 0.03445}{1.03445} = 8.27\%.$$

4.2 DCF with Multiple-Stage Growth

Firms often evolve through different stages in their growth. For example, some may have three stages during their lifetime:

1. Growth stage - rapidly expanding sales, high profit margins, and abnormally high growth in earnings per share, many new investment opportunities, low dividend payout ratio.

2. Transition stage - growth rate and profit margin reduced by competition, fewer new investment opportunities, high payout ratio.

3. Maturity stage - earnings growth, payout ratio and average return on equity stabilizes for the remaining life of the firm.

Example. In Example 1 ($D_0 = \$1$ and $r = 20\%$), suppose that the growth rate is 6% for the first 7 years and then drops to zero thereafter.

$P_0 = \$6.49$.

4.3 EPS AND P/E

Actual forecast of dividends often involves many practical issues.

Terminology:

- Earnings: total profit net of depreciation and taxes.
- Payout ratio: dividend/earnings = DPS/EPS = p.
- Retained earnings: (earnings - dividends).
- Plowback ratio: retained earnings/total earnings = b.
- Book value (BV): cumulative retained earnings.
- Return on book equity (ROE): earnings/BV.

Example. (Myers) Texas Western (TW) is expected to earn \$1.00 next year. Book value per share is \$10.00 now. TW plans an investment program which will increase net book assets by 8% per year. Earnings are expected to grow proportionally. The investment is financed by retained earnings. The discount rate is 10%, which is assumed to be the same as the rate of return on new investments. Price TW's shares if

1. TW expands at 8% forever.
2. TW's expansion slows down to 4% after year 5.

Here

- Plowback ratio $b = (10)(0.08)/(1) = 0.8$
- Payout ratio $p = (1 - 0.8)/(1) = 0.2$
- ROE $= 10\%$.

1. Continuing expansion.

$$g = \text{ROE} \times b = (0.10)(0.8) = 0.08.$$

$$D_1 = \text{EPS}_1 \times p = (1)(0.2) = 0.2.$$

$$P_0 = \frac{D_1}{r - g} = \frac{0.2}{0.10 - 0.08} = \$10.00.$$

2. 2-stage expansion. Forecast EPS, D, BVPS by year:

Year	0	1	2	3	4	5	6
EPS		1.00	1.08	1.17	1.26	1.36	1.47
Investment		0.80	0.86	0.94	1.00	1.08	0.59
Dividend		0.20	0.22	0.23	0.26	0.28	0.88
BVPS	10.00	10.80	11.66	12.60	13.60	14.69	15.28

$$P_0 = \sum_{t=1}^{5} \frac{D_t}{(1.1)^t} + \frac{1}{(1.1)^5} \frac{0.88}{(0.10 - 0.04)} = \$10.00.$$

Question: Why are the values the same under both scenarios?

4.4 Growth Opportunities and Growth Stocks

Definition: Growth opportunities are investment opportunities that earn expected returns *higher* than the required rate of return on capital.

Definition: Stocks of companies that have access to growth opportunities are considered growth stocks.

- The following may not be growth stocks
  - A stock with growing EPS
  - A stock with growing dividends
  - A stock with growing assets.

- The following may be growth stocks
  - A stock with EPS growing slower than required rate of return.
  - A stock with DPS growing slower than required rate of return.

Example. Growth stock. ABC Software has the following data: Expected EPS next year is \$8.33; Payout ratio is 0.6; ROE is 25%; and, cost of capital is $r = 15\%$.

Thus,

$$D_1 = p \times \text{EPS} = (0.6)(8.33) = \$5.00$$

$$g = b \times \text{ROE} = (0.4)(0.25) = 0.10.$$

- Following a no-growth policy ($g = 0$ & $p = 1$), its value is
$$P_0 = \frac{D_1}{r-g} = \frac{\text{EPS}_1}{r} = \frac{8.33}{0.15} = \$55.56.$$
- Following the growth policy, its price is
$$P_0 = \frac{D_1}{r-g} = \frac{5.00}{0.15-0.10} = \$100.$$
- The difference of $100 - 55.56 = \$44.44$ comes from the growth opportunities, which offers a return of 25%, higher than the required rate of return 15%.

At $t = 1$: ABC can invest $(0.4)(8.33) = \$3.33$ at a permanent 25% rate of return. This investment generates a cash flow of $(0.25)(3.33) = \$0.83$ per year starting at the $t = 2$. Its NPV at $t = 1$ is

$$NPV_1 = -3.33 + \frac{0.83}{0.15} = \$2.22.$$

At $t = 2$: Everything is the same except that ABC will invest \$3.67, 10% more than at $t = 1$ (the growth is 10%). The investment is made with NPV being

$$NPV_2 = (2.22)(1.1) = \$2.44.$$

...

The total present value of growth opportunities (PVGO) is

$$\text{PVGO} = \frac{NPV_1}{r - g} = \frac{2.22}{0.15 - 0.10} = \$44.44.$$

This makes up the value difference between growth and no-growth.

Stock price has two components:

1. Present value of earnings under a no-growth policy
2. Present value of growth opportunities

$$P_0 = \frac{\text{EPS}_1}{r} + \text{PVGO}.$$

Terminology:

- Earnings yield: $\text{E/P} = \text{EPS}_1/P_0$
- P/E ratio: $\text{P/E} = P_0/\text{EPS}_1$

Note: In newspapers, P/E ratios are often given using most recent earnings. But investors are more concerned with price relative to future earnings.

Thus,

- If PVGO $= 0$, P/E ratio equals inverse of cost of capital
$$\text{E/P} = \frac{1}{r}.$$
- If PVGO > 0, P/E ratio becomes higher:
$$\text{P/E} = \frac{1}{r} + \frac{\text{PVGO}}{\text{EPS}_1} > \frac{1}{r}.$$
- PVGO is positive only if firm earns more than cost of capital.

5 Valuation of Operating Business

From DCF formula, we have

$$PV = \sum_{t=1}^{T} \frac{FCF_t}{(1+r)^t} + \frac{PV_T}{(1+r)^T}$$

where 1 to T is the growth period and

$FCF_t \equiv$ Free Cash Flow (Earnings - Net Investment)

(Net investment = Capital expenditure - Depreciation.)

Calculation of PV_T:

1. Perpetual-growth DCF
2. P/E multiplier
3. P/BVPS multiplier
4. Choose T to be when PVGO goes to zero. Then

$$PV_T = \frac{FCF_{T+1}(\text{No Growth})}{r}.$$

Example. Concatenator Manufacturing Division (BM).

TABLE 4.5

Forecasts of free cash flow, in $ millions, for the Concatenator Manufacturing Division. Rapid expansion in years 1–6 means that free cash flow is negative, because required additional investment outstrips earnings. Free cash flow turns positive when growth slows down after year 6.

	YEAR									
	1	2	3	4	5	6	7	8	9	10
Asset value	10.00	12.00	14.40	17.28	20.74	23.43	26.47	28.05	29.73	31.51
Earnings	1.20	1.44	1.73	2.07	2.49	2.81	3.18	3.36	3.57	3.78
Investment	2.00	2.40	2.88	3.46	2.69	3.04	1.59	1.68	1.78	1.89
Free cash flow	–.80	–.96	–1.15	–1.39	–.20	–.23	1.59	1.68	1.79	1.89
Earnings growth from previous period (%)	20	20	20	20	20	13	13	6	6	6

Notes:

1. Starting asset value is $10 million. Assets required for the business grow at 20 percent per year to year 4, at 13 percent in years 5 and 6, and at 6 percent afterward.
2. Profitability is constant at 12 percent.
3. Free cash flow equals earnings minus net investment. Net investment equals total capital expenditures less depreciation. Note that earnings are also calculated net of depreciation.

Summary of Data:

- Discount rate for CMD $r = 10\%$
- Three stage growth:
  - Fast growth in years 1 to 4
  - Slowing growth in years 5 to 6
  - Long-run growth of 6% after year 6

$$\begin{aligned}\text{PV(business)} &= \text{PV(FCF from year 1 to 6)} \\ &+ \text{PV(Horizon value).}\end{aligned}$$

$$\text{PV(FCF)} = -\$3.6\text{M}$$

$$\text{PV}_T \equiv \text{Horizon Value} = ?$$

Perpetual Growth of 6% after $t = 6$:

$$\text{PV}_6 = \frac{1.59}{0.10 - 0.06} = 39.75.$$

Thus

$$\text{PV} = -3.6 + \frac{39.75}{1.1^6} = \$18.8\text{M}.$$

Other Approaches to PV_T:

- Normal P/E of 11 at $t = 6$:

  $$\mathrm{PV}_6 = (11)(3.18) = 34.98.$$

  Thus

  $$\mathrm{PV} = -3.6 + \frac{34.98}{1.1^6} = \$16.1\mathrm{M}.$$

- Normal P/BVPS of 1.4 at $t = 6$:

  $$\mathrm{PV}_6 = (1.4)(23.43) = 32.80.$$

  (Alternatively, $\mathrm{PV}_T = (1.4)(26.47)/1.1 = 33.69$.)

  Thus

  $$\mathrm{PV} = -3.6 + \frac{32.80}{1.1^6} = \$14.9\mathrm{M}$$

  (most conservative number).

6 Summary

- Risky CFs should be discounted using a risk-adjusted rate.
- Cash flows, typically, do not grow at a constant rate.
- Growh opportunities earn higher return than cost of capital.

7 Homework

Readings:

- BMA Chapter 4.
- BKM Chapter 18.

Assignment:

- Problem Set 3.