# Chapter 4

# Common Stocks

**Road Map**

**Part A** Introduction to finance.

**Part B** Valuation of assets given discount rates.

- Fixed-Income securities.
- Stocks.
- Forward and futures.
- Options.

**Part C** Determination of discount rates.

**Part D** Introduction to corporate finance.

## Main Issues

- Dividend Discount Model (DDM)
- Modeling Cash Flows
- EPS and P/E
- Growth Opportunities and Growth Stocks
- Discount Rates

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# 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's 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 in two forms:
  - Cash dividend
  - Stock dividend.
- Contrary to payments to bondholders, payments to common stockholders are uncertain in both magnitude and timing.
- Important characteristics of common stock:
  1. Residual claim - common stockholders have claim to firm's cash flows and assets *after* all obligations to creditors and preferred stockholders are met
  2. Limited liability - common stockholders may lose their investments, but no more
  3. Voting rights - Common 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 specialist 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 an investment bank who acts as an underwriter: it buys the whole issue and resells it to the public.

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

# 3 Dividend Discount Model

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

1. Expected future dividends
2. Discount rates for dividends.

Notation:

$P_t$: Price of stock at $t$ (ex-dividend)

$D_t$: Cash dividend at $t$

$\mathrm{E}_t[\cdot]$: Expectation (forecast) at $t$

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

## Dividend Discount Model (DDM)

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

Applying DCF formula, we have the Dividend Discount Model:

$$P_0 = \sum_{t=1}^{\infty} \frac{\mathrm{E}_0[D_t]}{(1+r_t)^t}.$$

Assumption: There are no "bubbles".

(One definition of bubbles is given later.)

Additional Assumption: $r_t = r$, i.e., expected rates of return for all horizons are the same and constant over time.

$$P_0 = \sum_{t=1}^{\infty} \frac{\mathrm{E}_0[D_t]}{(1+r)^t}.$$

## Valuation Based on Finite Holding Period

1. Stock price at $t = 0$ reflects:
   - Value of dividend at $t = 1$, $D_1$
   - Value of stock after dividend at $t = 1$, $P_1$

   $$P_0 = \frac{\mathrm{E}_0[D_1]}{1+r} + \frac{\mathrm{E}_0[P_1]}{1+r}.$$

2. What determines $P_1$?

   $$P_1 = \frac{\mathrm{E}_1[D_2]}{1+r} + \frac{\mathrm{E}_1[P_2]}{1+r}.$$

3. Today's forecast of future forecasts equals today's forecast:

   $$\mathrm{E}_0\left[\mathrm{E}_1[\cdot]\right] = \mathrm{E}_0[\cdot].$$

   - Forecast only changes when there is a surprise.

     $$\mathrm{E}_1[\cdot] - \mathrm{E}_0[\cdot] = \text{Surprises after time 0}$$

   - Surprises cannot be forecasted.

     $$\mathrm{E}_0\left[\mathrm{E}_1[\cdot] - \mathrm{E}_0[\cdot]\right] = \mathrm{E}_0[\text{Surprises after time 0}] = 0$$

     $$\Rightarrow \quad \mathrm{E}_0[\mathrm{E}_1[\cdot]] = \mathrm{E}_0[\cdot].$$

4. Thus,

$$\begin{aligned}
P_0 &= \frac{\mathrm{E}_0[D_1]}{1+r} + \frac{1}{1+r}\left(\frac{\mathrm{E}_0[D_2]+\mathrm{E}_0[P_2]}{1+r}\right) \\
&= \frac{\mathrm{E}_0[D_1]}{1+r} + \frac{\mathrm{E}_0[D_2]}{(1+r)^2} + \frac{\mathrm{E}_0[P_2]}{(1+r)^2} \\
&= \frac{\mathrm{E}_0[D_1]}{1+r} + \frac{\mathrm{E}_0[D_2]}{(1+r)^2} + \frac{\mathrm{E}_0[D_3]}{(1+r)^3} + \frac{\mathrm{E}_0[P_3]}{(1+r)^3} \\
&= \sum_{t=1}^{\infty} \frac{\mathrm{E}_0[D_t]}{(1+r)^t} + \lim_{T\to\infty} \frac{\mathrm{E}_0[P_T]}{(1+r)^T} \\
&= \sum_{t=1}^{\infty} \frac{\mathrm{E}_0[D_t]}{(1+r)^t} \qquad \text{if} \quad \lim_{T\to\infty} \frac{\mathrm{E}_0[P_T]}{(1+r)^T} = 0
\end{aligned}$$

where the "no-bubble" condition is

$$\lim_{T\to\infty} \frac{\mathrm{E}_0[P_T]}{(1+r)^T} = 0.$$

Observation: DDM does not require holding the stock forever.

Applications of DDM involve further assumptions on

1. Future dividends
2. Discount rates.

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

# 4 Modeling Cash Flows

## 4.1 DDM with Constant Growth

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

$$\mathrm{E}_0[D_{t+1}] = (1+g) \times \mathrm{E}_0[D_t].$$

Then

$$\begin{aligned} P_0 &= \sum_{t=1}^{\infty} \frac{\mathrm{E}_0[D_t]}{(1+r)^t} = \sum_{t=1}^{\infty} \frac{(1+g)^{t-1}}{(1+r)^t} \mathrm{E}_0[D_1] \\ &= \frac{\mathrm{E}_0[D_1]}{r-g} \quad \text{if} \quad r > g. \end{aligned}$$

Finally, $\mathrm{E}_0[D_1] = (1+g)D_0$, where $D_0$ is the current dividend. Thus, we have the Gordon Model:

$$\boxed{P_0 = \frac{\mathrm{E}_0[D_1]}{r-g} = \frac{1+g}{r-g} D_0.}$$

**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

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

▶ DDM 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 DDM with Multiple-Stage Growth

Firms often evolve through different stages in its growth. For example, some 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.

$P_0 = \$6.045$.

# 5 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 share price 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.

$$\begin{aligned} g &= \text{ROE} \times b = (0.10)(0.8) = 0.08. \\ D_1 &= \text{EPS}_1 \times p = (1)(0.2) = 0.2. \\ P_0 &= \frac{D_1}{r-g} = \frac{0.2}{0.10 - 0.08} = \$10.00. \end{aligned}$$

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 |

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

<u>Question</u>: Why are the values the same under both scenarios?

# 6 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.

**Example.** IBM in the 60's and 70's.

Note:

1. The following may not be growth stocks

- A stock with growing EPS

- A stock with growing dividends

- A stock with growing assets.

2. 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,

$$
\begin{aligned}
D_1 &= p \times \text{EPS} = (0.6)(8.33) = \$5.00 \\
g &= b \times \text{ROE} = (0.4)(0.25) = 0.10.
\end{aligned}
$$

- 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: E/P = $\text{EPS}_1 / P_0$
- P/E ratio: 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 the firm earns more than its cost of capital.

# 7 Discount Rates

**Example.** Assets A, B and C have following cash flows:

| | $CF_1$ | $CF_2$ | $CF_3$ | $\cdots$ | $CF_t$ | $\cdots$ |
|---|---|---|---|---|---|---|
| A | $\tilde{d}_1$ | 0 | 0 | $\cdots$ | 0 | $\cdots$ |
| B | $\tilde{d}_1$ | $\tilde{d}_2$ | $\tilde{d}_3$ | $\cdots$ | $\tilde{d}_t$ | $\cdots$ |
| C | $\tilde{d}_1$ | $\tilde{d}_1 \cdot \tilde{d}_2$ | $\tilde{d}_1 \cdot \tilde{d}_2 \cdot \tilde{d}_3$ | $\cdots$ | $\tilde{d}_1 \cdots \tilde{d}_t$ | $\cdots$ |

where $\tilde{d}_t$ are independent random variables with the same distribution and a mean of 1.00. Suppose that the risk-free rate is 5% and the required rate of return is 20% for asset A. Further assume that these rates are constant over time.

1. Asset A:

$$PV_A = \frac{1.00}{1.2} = \$0.83.$$

2. Asset B:

- PV of $CF_1$ at $t = 0$ is \$0.83
- PV of $CF_2$ at $t = 1$ is \$0.83
- PV of $CF_2$ at $t = 1$ is known for sure at $t = 0$
- PV of $CF_2$ at $t = 0$ is

$$\text{PV}_0(CF_2) = \frac{0.83}{1.05} \quad \text{(discounted at risk-free rate!)}$$

- $\cdots$

$$PV_B = 0.83 + \sum_{t=1}^{\infty} \frac{0.83}{(1.05)^t} = 0.83 + \frac{0.83}{0.05} = 17.50.$$

3. Asset C:

- PV of $CF_1$ at $t = 0$ is \$0.83
- PV of $CF_2$ at $t = 1$ is \$$(0.83 \times \tilde{d}_1)$
- PV of $CF_2$ at $t = 0$ is

$$\text{PV}_0(CF_2) = (0.83) \times \text{PV}_0(\tilde{d}_1) = \frac{0.83}{1.2} = \frac{1}{(1.2)^2}$$

- $\cdots$

$$PV_C = 0.83 + \sum_{t=1}^{\infty} \frac{0.83}{(1.2)^t} = 0.83 + \frac{0.83}{0.2} = 5.00$$

# 8 Summary

- Risky CFs should be discounted using a risk-adjusted rate.
- Cash flows, typically, do not grow at a constant rate.
- Risk, typically, does not accumulate at a constant rate.
- Key Assumptions of DDM with Constant Discount Rate:
  1. No bubbles
  2. Flat term structure for discount rates
  3. Risk accumulates over time at a constant rate.

# 9 Homework

## Readings:

- BKM Chapter 18.
- BM Chapter 4.

## Assignment:

- Problem Set 3.

 