Chapter 8

Stock Valuation

(Homework: 4, 13, 21 & 23)

Models of Stock Valuation

- **Balance Sheet Models**
- **Dividend Discount Models**
- **New Development**

Review: Efficient Market Hypothesis

- **Consider a “two-stock” market. If the market can distinguish good from bad, what will happen?**
- **Equilibrium -- No “good” or “bad” stocks. Current stock prices accurately reflect all available info (i.e. market is efficient)**
- **Equilibrium concept is everywhere**

Why A Stock Valuation Model?

- Market is unlikely to be fully efficient all the time
- Need a metric for "fair price (F)" of each stock that can differ from market price (MP)
- Trading Signal
  - F > MP
  - F < MP
  - F = MP

Common Stock Cash Flows and the Fundamental Theory of Valuation

- In 1938, John Burr Williams postulated what has become the fundamental theory of valuation:

  The value of *any* financial asset equals the present value of all of its future cash flows.

- For common stocks, this implies the following:

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{P_1}{(1+r)^1} \quad \text{and} \quad P_1 = \frac{D_2}{(1+r)^1} + \frac{P_2}{(1+r)^1}$$

substituting for P_1 gives

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \frac{P_2}{(1+r)^2} .$$

$$P_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \frac{D_4}{(1+r)^4} + \ldots$$

Dividend Discount Models (DDM)

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

- V_0 = Value of Stock
- D_t = Dividend
- r = required return, or discount rate

Case 1: No Growth Model

$$V_o = \frac{D}{r}$$

- Stocks that have earnings and dividends that are expected to remain constant (perpetuity)
- Preferred Stock

No Growth Model: Example

$$V_o = \frac{D}{r}$$

D = $5.00

r = .15

V_0 =

V_1 =

Case 2: Constant Growth (Gordon Model)

$$Vo = \frac{D_o(1+g)}{r-g}$$

- g = constant perpetual growth rate
- What if g = 0 ?

Gordon Model: Example

$$Vo = \frac{D_o(1+g)}{r-g}$$

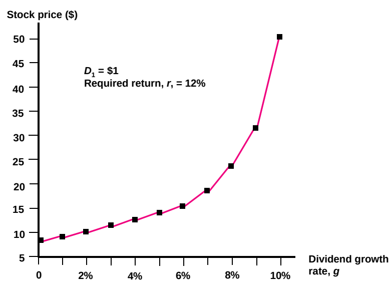
D_0 = \$5.00

g = 8% r = 15%

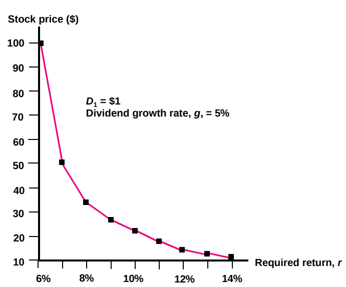
D_1 =

V_0 =

Stock Price Sensitivity to Dividend Growth, *g*



Stock Price Sensitivity to Required Return, *r*



Common Stock Valuation - The Nonconstant Growth Case

- For many firms (especially those in new or high-tech industries), dividends are low and expected to grow rapidly. As product markets mature, dividends are then expected to slow to some "steady state" rate. How should stocks such as these be valued?
- Answer: We return to the fundamental theory of value - the value today equals the present value of all future cash flows.
- Put another way, the ***nonconstant growth model*** suggests that

P_0 = present value of dividends in the nonconstant growth period(s)

+ present value of dividends in the "steady state" period.

Chapter 8 Quick Quiz -- Part 1 of 3

- Suppose a stock has just paid a $5 per share dividend. The dividend is projected to grow at 5% per year indefinitely. If the required return is 9%, then the price today is _______ ?

P_0 =

What will the price be in a year?

P_1 =

- By what percentage does P_1 exceed P_0? Why?

Chapter 8 Quick Quiz -- Part 2 of 3

- Find the required return:

Suppose a stock has just paid a $5 per share dividend.
The dividend is projected to grow at 5% per year indefinitely.
If the stock sells today for $65 5/8, what is the required return?

P_0 = $D_1/(r - g)$
$(r - g)$ = D_1/P_0
r = $D_1/P_0 + g$
=
= dividend yield (_____) + capital gain yield (_____)
= ____

Summary of Stock Valuation (Table 8.1)

I. The General Case

In general, the price today of a share of stock, P_0, is the present value of all its future dividends, D_1, D_2, D_3, . . .

$$P_0 = \frac{D_1}{(1 + r)^1} + \frac{D_2}{(1 + r)^2} + \frac{D_3}{(1 + r)^3} + \ldots$$

where *r* is the required return.

II. Constant Growth Case

If the dividend grows at a steady rate, *g*, then the price can be written as:

$P_0 = D_1/(r - g)$

This result is the ***dividend growth model***.

III. The Required Return

The required return, r, can be written as the sum of two things:

$r = D_1/P_0 + g$

where D_1/P_0 is the ***dividend yield*** and g is the ***capital gain yield***.

Stock Market Reporting

- Primary vs. secondary markets
- Growth opportunities
  - Share price for a firm that pays in perpetuity all earnings as dividends but which has no growth opportunities
    P = EPS/r = Div/r
  - Share price for the same firm with growth opportunities
    P = EPS/r + NPVGO
  - We can relate this to the Price earnings ratio by dividing the equation by EPS:
    P/E = 1/r + NPVGO/EPS

Sample Stock Quotation from *The Financial Post*

The Financial Post, June 17, 1998, p.32
Toronto Quotations as of June 16, 1998

52 Weeks Hi	52 Weeks Lo	Stock	Sym	Div	Yld %	PE	Vol 00s	Hi	Lo	Close	Net Chg.
30.60	27.00	Bell10pf	BC	1.86	6.7	...	nt	29.00	27.30	27.90	...
3.60	0.61	Bellator	BEX	...	...	...	290	0.65	0.65	0.65	...
9.15	2.35	Bemagld	BGO	...	...	...	1085	2.70	2.60	2.65	+0.08
2.05	1.00	Benson	BEN	...	...	18.3	26	1.23	1.10	1.10	...
39.55	25.00	BombardrA	BBD	0.34	0.9	29.5	8	37.45	36.85	36.90	-.25

Source: Reprinted by permission of *The Financial Post*,, June 17, 1998, p.32.

Chapter 8 Quick Quiz -- Part 3 of 3

- **Suppose a stock has just paid a $5 per share dividend. The dividend is projected to grow at 10% for the next two years, the 8% for one year, and then 6% indefinitely. The required return is 12%. What is the stock's value?**

Problem 8.1

- **Green Mountain, Inc. just paid a dividend of $3.00 per share on its stock. The dividends are expected to grow at a constant 5 percent per year indefinitely. If investors require a 12 percent return on MegaCapital stock, what is the current price? What will the price be in 3 years? In 15 years?**

Problem 8.10

- **Metallica Bearings, Inc. is a young start-up company. No dividends will be paid on the stock over the next 5 years. The company will then begin paying a $6.00 dividend, and will increase the dividend by 5% per year thereafter. If the required return on this stock is 23%, what is the current share price?**

Problems with DDM

- Constant discount rate
- Constant dividend growth rate
- How informative are dividends? What about zero-dividend stocks?
- How stocks have been valued historically?
- Same accounting numbers --> Same stock Price

Residual Income Model

- Developed in the accounting literature
- Built on DDM, with accounting assumptions
- Focus on earnings rather than dividends
- V = book value + PV (future residual income)

What factors affect a stock's price?

1.
2.
3.

- Other firm-specific business conditions
  -
  -
  -

Bakshi-Chen-Dong (BCD) Stock Valuation Model

- **A Generalization of DDM**
- **Uses earnings per share (EPS) instead of dividends. Advantages:**
- **Introduces stochastic components to the model**
- **Combines**

Continuous-time Finance

- **The BCD model is derived in a Continuous-time framework - Assume trading time and business conditions (interest rate, earnings, etc.) are continuous.**
- **Since trading is not continuous, we discretize business variables in applications.**

Interest Rate

- **Stochastic interest rate: Vasicek (mean-reverting) process**

$$dR(t) = k_r[m_r - R(t)]dt + s_r dw_r(t)$$

- **Stochastic pricing kernel -- No Arbitrage**

Earnings and Dividends

- Stochastic earnings: Earnings follow Geometric Brownian motion, with a mean-reverting growth rate:

$$\frac{dY(t)}{Y(t)} = G(t)dt + s_y dw_y(t)$$
$$dG(t) = k[m_g - G(t)]dt + s_g dw_g(t)$$

- dw_y and dw_g are Brownian motions (stochastic components).
- Dividend assumed to be a proportion of earnings:

– Dividend = δ *EPS + noise

D(t) = δY(t) + e(t)

Dealing with Negative Earnings

- Why are negative earnings troublesome?
- What is the growth rate of earnings if earnings are negative (e.g. from -2 to -1)?
- Solution:

The BCD Model

- Following standard steps in asset pricing we arrive at a partial differential equation (PDE) for the stock price.
- needs to be solved numerically.
- Estimating 11 parameters. How?

  - Use 24 months of data to ‘calibrate’ the model. Effectively we are minimizing the error in the estimation period using previous 24 months market prices as a benchmark. The parameters capture a ‘pricing rule’ for each stock.

- Then we compute model price using 3 inputs (Interest rate, EPS0, EPS1)

Features of BCD Model

- Sound economic foundation - No arbitrage
- Takes into account firm's business conditions and market's historical valuation standards -- How?
- Takes into account market expectation --How?
- Can price any stock with earnings forecast data. No problems with no-dividend, negative earnings, negative book value

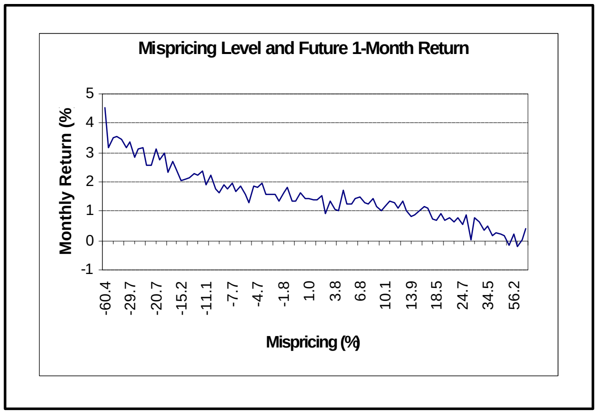
A Definition of Mispricing

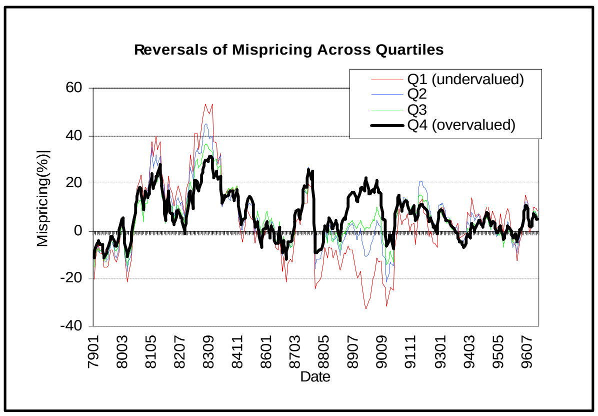
$$\text{Mispricing} = \frac{\text{Market Price - Model price}}{\text{Model price}}$$

- Negative mispricing means ___________
- Positive mispricing means ___________

What Makes a Good Model?

1. Zero average mispricing with small variance over time.
2. Fast mean-reversion of mispricing.
3. Mispricing should be significant predictor of future returns.


Mispricing Level and Future 1-Month Return
Monthly Return (%
Mispricing (%)
5
4
3
2
1
0
-1
-60.4
-29.7
-20.7
-15.2
-11.1
-7.7
-4.7
-1.8
1.0
3.8
6.8
10.1
13.9
18.5
24.7
34.5
56.2


Reversals of Mispricing Across Quartiles
Q1 (undervalued)
Q2
Q3
Q4 (overvalued)
Mispricing(%)|
Date
60
40
20
0
-20
-40
7901
8003
8105
8207
8309
8411
8601
8703
8805
8907
9009
9111
9301
9403
9505
9607