Lecture Notes 11

Equity Valuation

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Buzz Words: Dividend Discount Model (DDM), Gordon Model, Intrinsic Value, Discount Rate, Capitalization Rate, Growing Perpetuity, Plowback, ROE, Growth Stocks
I. Readings and Suggested Practice Problems

BKM, Chapter 18, Sections 1-4, 7.


Web: [www.multexinvestor.com](http://www.multexinvestor.com) - enter a stock name (e.g. IBM) and view a snapshot of company data, including P/E ratios and betas.

II. Valuation and its Uses

A. *The Questions we’d like to Answer:*

- The *WSJ* reports:

  - IBM price per share: $109
  - GE price per share: $139

  Question 1: Are these stock values “Correct?”

  Question 2: What assumptions could justify these values?

- Consider the typical *NYT* or *WSJ* headlines presented on the next page:

  Question: Is this behavior of markets consistent with a rational valuation model?
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[NYT and WSJ headlines here]
B. Definition of Valuation

1. Valuation is the art/science of determining what a security or asset is worth.

2. Sometimes we can observe a market value for a security and we are interested in assessing whether it is over or under valued (e.g., stock analysis); sometimes there is no market value and we are trying to construct one for bargaining or transaction purposes (e.g., a corporation is interested in selling a division).

3. The value of a security or asset is going to depend crucially on the asset pricing model we choose. (As we shall see next, the effect is through the appropriate discount rate.)

4. The most common kind of valuation problem is equity valuation.

(Although we focus on the market for equities, the valuation models described below are applicable to other securities and assets as well.)
III. Present Value Models

A. General Approach

1. These models assume that the stock is bought, held for some time (dividends and other cash distributions are collected), and then sold.

2. The stock is valued as the present value of the expected cash distributions and the expected proceeds from the sale. BKM call this the “intrinsic value.”

3. For brevity and notational simplicity, we refer to periodic cash distributions generically as “dividends.” Therefore, dividends, when relevant, should be understood to include any cash distributed to shareholders, in particular through share buybacks (you can read more about share repurchasing in the Additional Readings).
B. Assume that dividends are paid annually and that the time 0 dividend has just been paid

1. If the stock is held one year, the return, $r$, on the stock is

$$ r = \frac{D_t + P_t}{P_0} - 1 $$

where $D_t$ is firm’s dividend per share at time $t$ and $P_t$ is the stock price of the firm at $t$. Taking expectations and rearranging gives

$$ P_0 = \frac{E[D_t + P_t]}{1 + E[r]} $$

• Present value considers the expected cash flows received if we buy the stock:
  — Expected dividends,
  — Expected price received upon sale of the stock at conclusion of holding period

• The discount rate is our required rate of return (given the risk of the stock).

2. If the stock is held for two years, the present value is given by

$$ P_0 = \frac{E[D_t]}{1 + E[r]} + \frac{E[D_{t+1} + P_{t+1}]}{(1 + E[r])^2} $$

[What is the underlying assumption here?]
3. If the stock is held forever, the present value is given by (using repeated substitution, similarly to the step from 1 and 2 above)

\[
P_0 = \frac{E[D_1]}{1 + E[r]} + \frac{E[D_2]}{(1 + E[r])^2} + \ldots + \frac{E[D_t]}{(1 + E[r])^t} + \ldots
\]

\[
= \sum_{t=1}^{\infty} \frac{E[D_t]}{(1 + E[r])^t}
\]

which is known as a dividend discount model (DDM).

4. Simplifying the Notation: Let

\[
k = E[r]
\]

be the discount rate (the “required rate of return,” also called the “capitalization rate,” – typically assumed to be the \(E[r]\) from the CAPM’s SML, but one can use more elaborate asset pricing models). So, given the expected value of future cash flow, the (systematic) **risk adjustment** is performed via discounting.

When we want to stress that the DDM calculates the intrinsic value (which may differ from the observed price), we denote the result \(V_0\), and usually write the sum without the \(E[\ ]'s:

\[
V_0 = \frac{D_1}{(1 + k)} + \frac{D_2}{(1 + k)^2} + \frac{D_3}{(1 + k)^3} + \frac{D_4}{(1 + k)^4} + \ldots
\]

\([P_0 \text{ is sometimes used for the intrinsic value and sometimes for the observed price, so its meaning should be understood in the context of a given discussion.}]


C. Discussion

1. The last formula highlights the relation between expected return and price and why we call a model that tells us something about expected return an asset pricing model.

2. We can see that holding expected dividends fixed, stock price today is decreasing in expected stock return; the higher the expected return needed to compensate for the stock's risk the lower the stocks price.

D. Two items affect the intrinsic value of an asset:

1. Expected Return.


IV. Approaches to Expected Return Determination

1. In a CAPM framework, use the SML; this approach allows you to explicitly make adjustments to your Beta estimate to reflect your assessment of the future Beta of the stock.

2. If valuing existing equity, can also use a historical average return as an estimate of expected return.

3. Can also adjust the estimate to take into account the predictability of returns and to allow for the sensitivity of the stock to other sources of risk; we will not focus on these adjustments here.
V. Constant Growth DDM

A. The Model (also known as the Gordon Model)

Assume dividends grow at a constant compound growth rate $g$:

$$D_2 = D_1 (1 + g)$$
$$D_3 = D_2 (1 + g) = D_1 (1 + g)^2$$
$$\vdots$$
$$D_t = D_{t-1} (1 + g) = D_1 (1 + g)^{t-1}$$

Assume $g < k$. Then the Intrinsic Value is a growing perpetuity:

$$V_0 = \frac{D_1}{(1+k)} + \frac{D_1 (1+g)}{(1+k)^2} + \frac{D_1 (1+g)^2}{(1+k)^3} + \cdots = \frac{D_1}{k-g}$$

B. Valuation Example (Date: 3/17/00; Was there a “bubble?”)

*From Bloomberg (see printouts on subsequent pages):*

Expected-earnings-per-share growth-rate for GE is 14.28%
For IBM is 13.05%
Dividends: GE $1.64, IBM $0.48

Beta GE = 1.37 (1.25 adjusted), IBM = 0.76 (0.84 adjusted)
Current $r_f = 6\%$
Historical average market risk premium $r_M - r_f$ approx 8%;

$$Er_{GE} = 6\% + 1.37(8\%) = 16.96\%,$$
$$Er_{IBM} = 6\% + 0.76(8\%) = 12.08\%.$$
For GE

The intrinsic value of GE is

\[ V_0 = \frac{D_1}{k - g} = \frac{D_0 (1 + g)}{k - g} = \frac{1.64 (1.1428)}{.1696 - .1428} = 69.9 \quad (\text{vs. } 139) \]

Solving for \( k \):

\[ 139 = \frac{1.64 (1.1428)}{k - .1428} \Rightarrow k = 15.63 \% \quad (\text{vs. } 16.96\%) \]

Solving for \( g \):

\[ 139 = \frac{1.64 (1 + g)}{.1696 - g} \Rightarrow g = 15.6\% \quad (\text{vs. } 14.28\%) \]

Based on Adjusted Beta of GE, \( k=6+1.25\times8=16\% \): the intrinsic value of GE is:

\[ V_0 = \frac{D_1}{k - g} = \frac{D_0 (1 + g)}{k - g} = \frac{1.64 (1.1428)}{.16 - .1428} = 108.96 \quad (\text{vs. } 139) \]

Based on Adjusted Beta and the highest estimate for growth of 15%:

\[ V_0 = \frac{D_1}{k - g} = \frac{D_0 (1 + g)}{k - g} = \frac{1.64 (1.15)}{.16 - .15} = 188.6 \quad (\text{vs. } 139) \]
For IBM

- The CAPM rate of return, $k=12.08\%$, is less than the expected 5 year growth rate, $g=13.05\%$, so cannot use the constant growth model with these values (which imply an infinite price).

- In this case, can go back to the general present value model and use a multi-stage valuation, where $k$ and $g$ vary over time (see example in suggested problem 9).

- Alternatively, can use a different model than the CAPM for $k$, or can use a lower growth estimate than the current mean value.

- Suppose indeed use the more conservative $g = 11.6\%$.

Then

$$V_0 = \frac{D_1}{k - g} = \frac{D_0(1 + g)}{k - g} = \frac{0.48(1.116)}{.1208 - .116} = 111.6 \quad \text{(vs. 109)}$$
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[GE data here]
[IBM data here]
VI. DDM, Investment Opportunities, and Payout Policy

Assume that Growth results from reinvestment of earnings (no other funds are raised)

- Payout ratio is dividends/earnings.
- Plowback ratio \( b = 1 - \text{payout ratio} < 1 \)

is the proportion of earnings that are reinvested in the firm, and we assume \( b \) to be constant over time (i.e., constant payout policy).

So, \( D_t = (1-b)E_t \),

where \( E_t \) is earnings per share.

- \( ROE \) is the expected return on equity, and it measures the investment opportunities of a firm (per unit of book value of equity).
  We assume \( ROE \) to be constant over time.

Questions:

What is the growth rate of \( B_t \), the Book Value of Equity per Share?

What is the growth rate of \( E_t \), the Earnings per Share?

What is the growth rate of \( D_t \), the Dividend per Share?
**Book Value Growth:**

\[ E_1 = ROE \times B_0 \]

\[ B_1 = B_0 + b \times E_1 = B_0 + b \times ROE \times B_0 = B_0 \times (1 + b \times ROE) \]

⇒ book value per share grows at rate \( b \times ROE \)

**Earnings’ Growth:**

\[ E_2 = ROE \times B_1 = ROE \times B_0 \times (1 + b \times ROE) = E_1 \times (1 + b \times ROE) \]

⇒ earnings per share grow at rate \( b \times ROE \)

(since \( ROE \) is constant)

**Dividend Growth:**

\[ D_2 = (1 - b) \times E_2 = (1 - b) \times E_1 \times (1 + b \times ROE) = D_1 \times (1 + b \times ROE) \]

⇒ dividend per share grows at rate \( b \times ROE \)

(since payout ratio is constant)

*So, if \( b \) and \( ROE \) are constant, all per share values grow at rate \( g = ROE \times b \).*
Therefore, Firm Value:

\[ V_0 = \frac{(1 - b)E_1}{k - g} = \frac{(1 - b)E_1}{k - b \times ROE} \]

• How does our dividend payout policy affect our firm value?

As long as \( ROE > k \), increasing \( b \) (retention) will increase \( V_0 \). (We are investing the shareholders money at a rate higher than they demand.)

If \( ROE < k \), increasing \( b \) (retention) will decrease \( V_0 \).
VII. The Price/Earnings Ratio

A. Definition

- The Price/Earnings or P/E ratio is defined as the price per share divided by the earnings per share (after interest).

Example
On 3/17/00, the WSJ reports the P/E ratio of IBM to be 27. (This can be obtained by dividing the price per share at the close of 3/16/00 by the earnings per share for 1999.)
On 10/31/03, the WSJ reports the P/E ratio of IBM to be 26.

- The P/E ratio is sometimes used to describe the price as “IBM is selling at 27 times earnings,” and hence P/E is often called “the multiple.”

B. Use of P/E for Valuation

The P/E ratio is sometimes used to get a rough measure of the intrinsic value of a company that is not publicly traded:

1. An average P/E ratio for all publicly traded firm in the industry is calculated.

2. The current earnings of the firm are multiplied by this average P/E to obtain an estimate of the firm's intrinsic value.

C. Caveat for the P/E Valuation Approach

Indiscriminate use of the P/E ratio for valuation purposes can lead to trouble because of unstable accounting practices distorting accounting earnings.
D. The Economic Meaning of the P/E Ratio

1. How P/E relates to plowback, growth, and risk adjustment?

Start with \[ V_0 = \frac{(1-b)E_1}{k - g} \]

Assume the market consensus valuation is the price: \[ V_0 \text{ (for the market)} = P_0 \]

Then

\[
\frac{P_0}{E_1} = \frac{(1-b)}{k - g}
\]

2. An alternative interpretation of P/E, emphasizing the importance of growth:

First note that the intrinsic value of a firm with \( b > 0 \) can be decomposed into two components:

With \( b = 0 \)

\[ V_0 = \frac{(1-b)E_1}{k - g} = \frac{E_1}{k} = \text{("No-growth value")} \]

With \( b > 0 \),

\[ V_0 = \frac{E_1}{k} + \left( \text{Present Value of Growth Opportunities} \right) \]
That is, if a firm paid out all its earnings as dividend \((b = 0)\), its stock price at time zero would be \(E_1/k\). The difference between this value and the constant growth DDM value is due to growth, and we call it the Present Value of Growth Opportunities (PVGO).

- When the PVGO is a large component of the price, the firm is often called a “Growth” firm.
- Since investors buy growth stocks for what they will be earnings many years later, a tiny change in outlook can have a dramatic impact on the present value.

Given the above decomposition of the stock value:

Assuming the market consensus valuation is the price : \(P_0 = V_0\).

Then,

\[
\frac{P_0}{E_1} = \frac{1}{k} + \frac{PVGO}{E_1}
\]

So, growth firms have high multiples because their price reflects large PVGO, which investors expect to realize in the (possibly distant) future.

VIII. Additional Readings