Dr. Minor Time Value of Money: Van Horne Chapter 4. The Valuation of Long-Term Securities

What is Value?

- **Going-concern value** represents the amount a firm could be sold for as a continuing operating business.
- **Book value** represents either:
  - **An asset:** the accounting value of an asset – the asset's cost minus its accumulated depreciation;
  - **A firm:** total assets minus liabilities and preferred stock as listed on the balance sheet.
- **Intrinsic value** represents the price a security "ought to have" based on all factors bearing on valuation. Intrinsic value is calculated as the present value of projected future earnings plus the future sale price of the firm.
- **Market value** is the value of a company according to the stock market. Market value is calculated by multiplying a company's shares outstanding by its current market price also known as market capitalization.

Bonds

A **bond** is a long-term debt instrument issued by a corporation or government.

- The **maturity value (MV)** [or face value] of a bond is the stated value. In the case of a US bond, the face value is usually $1,000.
- The bond's **coupon rate** is the stated rate of interest; the annual interest payment divided by the bond's face value.
- The **discount rate, k_d,** (capitalization rate) is dependent on the risk of the bond and is composed of the risk-free rate plus a premium for risk.

Different Types of Bonds

A **perpetual bond** is a bond that *never* matures. It has an infinite life.

Example

Bond P has a $1,000 face value and provides an 8% annual coupon. The appropriate discount rate is 10%. What is the value of the perpetual bond**?**

$$V = I / k_d$$

V = value of the bond
I = annual interest payment
k_d = discount rate

V = $1,000 (8%) = $80.
= $80/10% = $800.

Non-Zero Coupon Paying Bond
A non-zero coupon-paying bond is a coupon paying bond with a finite life.

V = I (PVIFA $_{kd, n}$) + MV (PVIF $_{kd, n}$) or V = PV (Interest Payments) + PV (MV)

PVIF = present value interest factor
V = value; I = interest payment; MV = maturity value
k_d = discount rate; n = number of periods

Example 4.14. Bond C has a $1,000 face value and provides an 8% annual coupon for 30 years. The appropriate discount rate is 10%. What is the value of the *coupon bond*?

1. Calculate the annual coupon payment: $1000 * .08. **$80**
2. Find the PV of an $80 annuity for 30 periods at 10%. **$754.16**
3. Find the PV of a bond with a MV of $1000 in 30 periods discounted at 10%. **$57.00**
4. Add the two PVs: **$754.16 + $57.00 = $811.16**

Zero-Coupon Bond
A **zero-coupon bond** is a bond that pays no interest but sells at a deep discount from its face value; it provides compensation to investors in the form of price appreciation.

Example 4.17. Bond Z has a $1,000 face value and a 30-year life. The appropriate discount rate is 10%. What is the value of the *zero-coupon bond*?

1. Find the PV of a bond with a MV of $1000 in 30 years discounted at 10%. **$57.00**

Semiannual Coupon Bond
Most bonds in the US pay interest twice a year (1/2 of the annual coupon).

Example 4.21. Bond C has a $1,000 face value and provides an 8% semi-annual coupon for 15 years. The appropriate discount rate is 10% (annual rate). What is the value of the *coupon bond*?

1. Calculate the annual coupon payment: $1000 * .08. **$80**
2. Divide the annual payment and discount rate by 2: **$40, 5%**
3. Find the PV of an $40 annuity for 30 periods at 5%. **$614.92**
4. Find the PV of a bond with a MV of $1000 in 30 periods discounted at 5%. **$231.00**
5. Add the two PVs: **$614.92 + $231.00 = $845.92**

Preferred Stock
Preferred Stock is a type of stock that promises a (usually) fixed dividend, but at the discretion of the board of directors. Preferred Stock has preference over common stock in the payment of dividends and claims on assets.

Example 4.28. Stock PS has an 8%, $100 par value issue outstanding. The appropriate discount rate is 10%. What is the value of the preferred stock**?**

Dividend = Div_P = $100 (8%) = $8.00. Discount rate of the preferred stock = k_P = **10%.**
Value = V = Div_P / k_P = $8.00 / 10% = **$80**

Common Stock

Common stock represents a residual ownership position in the corporation.

- ☐ Pro rata share of future earnings after all other obligations of the firm (if any remain).
- ☐ Dividends *may* be paid out of the pro rata share of earnings.

What cash flows will a shareholder receive when owning shares of common stock?

(1) Future dividends (PV of an annuity)
(2) Future sale of the common stock shares (PV of a FV)

There are three stock growth models: constant growth, zero growth, and growth phase models.

Constant Growth Model
The constant growth model assumes that dividends will grow forever at the rate g.

$$\frac{D_1}{(k_e - g)}$$

D_1: Dividend paid at time 1.
g : The constant growth rate.
k_e: Investor's required return.

Example 4.35. Stock CG has an expected dividend growth rate of 8%. Each share of stock just received an annual $3.24 dividend. The appropriate discount rate is 15%. What is the value of the common stock?
D_1 = $3.24 (1 + 0.08) = **$3.50**
$V_{CG} = D_1 / (k_e - g)$ = $3.50 / (0.15 - 0.08) = $3.50 / .07 = **$50**

Zero Growth Model
The zero-growth model assumes that dividends will grow forever at the rate g = 0.

$$\frac{D_1}{k_e}$$

D_1: Dividend paid at time 1.
k_e: Investor's required return.

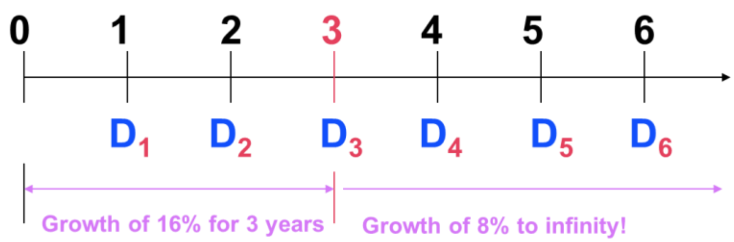
Example 4.37. Stock ZG has an expected growth rate of 0%. Each share of stock just received an annual $3.24 dividend per share. The appropriate discount rate is 15%. What is the value of the common stock?

D_1 = $3.24 (1 + 0) = **$3.24**
$V_{ZG} = D_1 / (k_e - 0)$ = $3.24 / (0.15 - 0) = $3.24 / .15 = **$21.60**

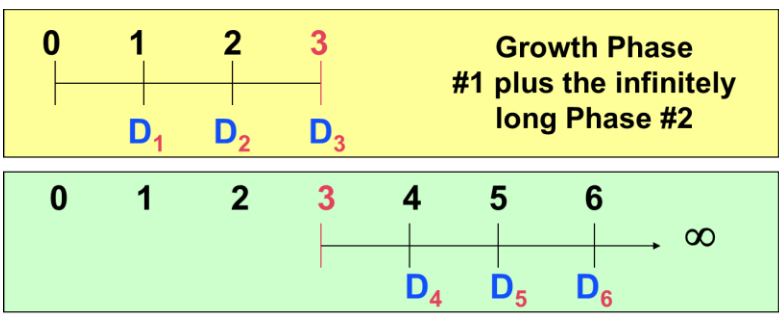
Growth Phases Model. The growth phases model assumes that dividends for each share will grow at two or more *different* growth rates.

Example 4.40. Stock GP has an expected growth rate of 16% for the first 3 years and 8% thereafter. Each share of stock just received an annual \$3.24 dividend per share. The appropriate discount rate is 15%. What is the value of the common stock under this scenario?

Step 1. Draw a timeline.



Step 2. Separate the timeline into two parts.



Step 3. Calculate the FV of the dividends. Note: g = growth rate.

D_0 = \$3.24 (Given and is already a PV)

$D_1 = D_0(1 + g_1)^1 = \$3.24(1.16)^1 = \$3.76$
$D_2 = D_0(1 + g_1)^2 = \$3.24(1.16)^2 = \$4.36$
$D_3 = D_0(1 + g_1)^3 = \$3.24(1.16)^3 =$ **\$5.06**

$D_4 = D_3(1 + g_2)^1 =$ **\$5.06**$(1.08)^1 = \$5.46$

Step 4. Calculate the PV of the FV of the dividends.
$PV(D_1) = D_1(PVIF_{15\%, 1}) = \$3.76\ (0.870) = \$\underline{3.27}$
$PV(D_2) = D_2(PVIF_{15\%, 2}) = \$4.36\ (0.756) = \$\underline{3.30}$
$PV(D_3) = D_3(PVIF_{15\%, 3}) = \$5.06\ (0.658) = \$\underline{3.33}$
$P_3 = \$5.46 / (0.15 - 0.08) = \$78$ [Constant Growth Model]
$PV(P_3) = P_3(PVIF_{15\%, 3}) = \$78\ (0.658) = \$\underline{51.32}$

Step 5. Add all the PV cash flows. You'll also find the *intrinsic value*.
V = \$3.27 + \$3.30 + \$3.33 + \$51.32 = \$61.22

Calculating Rates of Return (Yields)

Example 4.53. Julie Miller want to determine the yield to maturity (YTM) for an issue of outstanding bonds at Basket Wonders (BW). BW has an issue of 10% annual coupon bonds with 15 years left to maturity. The bonds have a current market value of $1,250. What is the YTM?

Nper = 15
PV = -$1250
PMT = $100 annual interest payment (10% x $1000 face value)
FV = $1000 (investor receives face value in 15 years)
Rate = **7.22%**

Example 4.61. Julie Miller want to determine the YTM for another issue of outstanding bonds. The firm has an issue of 8% semiannual coupon bonds with 20 years left to maturity. The bonds have a current market value of $950. What is the YTM?

Nper = 20-year semiannual bond (20 x 2 = 40)
PV = -$950
PMT = $40 annual interest payment (8% x $1000 = $80 face value/2)
FV = $1000 (investor receives face value in 15 years)
Rate = **4.26%**

Bond Price – Yield Relationship

Discount Bond – The market required rate of return exceeds the coupon rate (Par > P_0).
Premium Bond – The coupon rate exceeds the market required rate of return (P_0 > Par).
Par Bond – The coupon rate equals the market required rate of return (P_0 = Par).

When interest rates *rise*, then the market required rates of return *rise* and bond prices will *fall*.
Example 4.68. Assume that the required rate of return on a 15-year, 10% annual coupon paying bond *rises* from 10% to 12%. What happens to the bond price?

1. Calculate the interest payment: .10 * $1000 = **$100**
2. Calculate the PV of an annuity for $100 for 15 years at 10%. **$760.61**
3. Calculate the PV of a U.S. bond for 15 years at 10%. **$239.39**
4. Add the two values. **$1000**
5. Repeat steps 2-4 for 12%. **$681.09 + $182.70 = $863.79**

Therefore, the bond price has fallen from $1,000 to $864.

When interest rates fall, then the market required rates of return fall and bond prices will rise.
Example 4.71. Assume that the required rate of return on a 15-year, 10% annual coupon paying bond *falls* from 10% to 8%. What happens to the bond price?

1. Calculate the interest payment: .10 * $1000 = **$100**
2. Calculate the PV of an annuity for $100 for 15 years at 10%. **$760.61**
3. Calculate the PV of a U.S. bond for 15 years at 10%. **$239.39**
4. Add the two values. **$1000**
5. Repeat steps 2-4 for 12%. **$855.95 + $315.24 = $1171.19**

Therefore, the bond price has *risen* from $1000 to $1171.

The Role of Bond Maturity (See Valuation Spreadsheet 181016.)

The longer the bond maturity, the greater the change in bond price for a given change in the market required rate of return.

Example 4.74. Assume that the required rate of return on both the 5 and 15-year, 10% annual coupon paying bonds *fall* from 10% to 8%. What happens to the changes in bond prices?

The 5-year bond price has *risen* from $1,000 to $1,080 for the 5-year bond (+8.0%).
The 15-year bond price has *risen* from $1,000 to $1,171 (+17.1%). *Twice as fast!*

For a given change in the market required rate of return, the price of a bond will change by proportionally more, the lower the coupon rate.

The Role of the Coupon Rate (See Valuation Spreadsheet 181016.)

Example 4.78. Assume that the market required rate of return on two equally risky 15-year bonds is 10%. The annual coupon rate for Bond H is 10% and Bond L is 8%.
What is the rate of change in each of the bond prices if market required rates fall to 8%?

The price on Bond H and L prior to the change in the market required rate of return is $1,000 and $848 respectively.

The price for Bond H will rise from $1,000 to $1,171 (+17.1%).
The price for Bond L will rise from $848 to $1,000 (+17.9%). *Faster Increase!*

Determining the Yield on Preferred Stock

$P_0 = Div_P / k_P$
$k_P = Div_P / P_0$

Example 4.81. Assume that the annual dividend on each share of preferred stock is *$10*. Each share of preferred stock is currently trading at *$100*. What is the *yield* on preferred stock?
k_P = $10 / $100.
k_P = 10%.

Determining the Yield on Common Stock

Assume the constant growth model is appropriate. Determine the yield on the common stock.
$P_0 = D_1 / (k_e – g)$

Solving for k_e such that $k_e = (D_1 / P_0) + g$
Example 4.83 Assume that the expected dividend (D_1) on each share of common stock is *$3*. Each share of common stock is currently trading at *$30* and has an expected growth rate of *5%*. What is the *yield* on common stock?

k_e = ($3 / $30) + *5%*
k_e = 10% + 5% = *15%*