Discounted Cash Flow Valuation

KAPLAN SCHWESER

How to Use Your Calculator

Texas Instruments BA II Plus™ Professional

- We provide calculator setup and instruction in the resource library of your online portal.
- Check your settings (e.g., decimal places and payments per period).
- Get to know your calculator—it saves lots of time!

Present and Future Values

Given a **present value** and a **return**, we can calculate an **FV:**

- $FV = PV (1 + r)^t$

Given a **future value** and a **discount rate**, we can calculate a **PV:**

- $PV = FV / (1 + r)^t$

or

- $PV = FV / (1 + r)^{-t}$

Present and Future Values

Future value with **continuous compounding:**

- $FV = PV \times e^{rt}$

Present value with **continuous compounding:**

- $PV = FV \times e^{-rt}$

Zero-Coupon Bond (1)

Example:

A zero-coupon bond has a face value of $1,000 and 15 years to maturity. The bond's yield is 4% with annual compounding.
Calculate the price of the bond.

Zero-Coupon Bond (1): Solution

Using the PV formula:

$PV = FV / (1 + r)^t$

$= \$1{,}000 / (1.04)^{15} = \$555.26$

Using the calculator:

FV	= 1,000	(future / face value)
N	= 15	(bond maturity)
I/Y	= 4	(annual yield)
PMT	= 0	(no coupon payments)

CPT PV = $555.26

Zero-Coupon Bond (2)

Example:

A zero-coupon bond with 15 years to maturity has a face value of $1,000. Its current price is $555.26. **Calculate** the yield of the bond, assuming annual compounding.

Zero-Coupon Bond (2): Solution

Using the calculator:

FV	= 1,000	(future / face value)
PV	= –555.26	(current price, cash outflow to buy a bond)
N	= 15	(bond maturity)
PMT	= 0	(no coupons)

CPT I/Y = 4%

Zero-Coupon Bond With a Negative Yield

Example:

A zero-coupon bond with 15 years to maturity has a face value of $1,000. Its yield is a –0.5% yield with annual compounding. **Calculate** the price of the bond.

Zero-Coupon Bond With a Negative Yield: Solution

Using the PV formula:

PV = FV / $(1 + r)^t$

= \$1,000 / $(1 – 0.005)^{15}$ = \$1,078.09

Using the calculator:

FV	= 1,000	(future / face value)
N	= 15	(bond maturity)
I/Y	= –0.5	(annual yield)
PMT	= 0	(no coupon payments)

CPT PV = \$1,078.09

Fixed-Coupon Bond

Fixed coupon

- May be paid annually, semiannually, or quarterly
- Fixed percentage of the bond's face value (par value)
- Coupon remains fixed, but bond's yield may change

Fixed coupon vs. bond yield

- If the coupon = yield, bond will trade **at par**
- If the coupon > yield, bond will trade **above par**
- If the coupon < yield, bond will trade at a **discount to par**

Fixed-Coupon Bond

Example:

Consider a 10-year, 10% coupon, annual-pay bond with $1,000 par value and a yield to maturity of 8%.

Q1. **Determine** if the bond will be priced above, below, or at par (without a calculation).

Q2. **Calculate** the price of the bond.

Fixed-Coupon Bond: Solution

Q1. Will the bond trade above, below, or at par?

The coupon (10%) is > the yield (8%), so the bond will trade above par.

Q2. Calculate the price of the bond.

FV = 1,000

N = 10

I/Y = 8

PMT = 100 (10% × $1,000)

CPT PV = $1,134.20

Perpetual and Amortizing Bonds

Perpetual bonds

- Have no maturity date
- Also known as **perpetuities**
- PV of a perpetuity = cash flow received / required return

Amortizing bonds

- Regular payments to investors include **interest** and **principal**
- With fixed-coupon bonds, principal is only repaid at maturity
- Amortizing bonds are **annuity instruments**

Computing Loan Payments

Amortizing loan payments contain both interest and principal. This is also known as an **annuity payment**. Loan or mortgage payments are easily calculated using the TI BA II Plus.

Example:

Consider a $2,000 loan over a 13-year period with annual loan payments at the end of each year. The annual interest rate is 6%. **Calculate** the annual loan payment.

Computing Loan Payments: Solution

Annual loan payment:

PV	= 2,000	(receipt of the loan funds)
FV	= 0	(fully amortizing)
I/Y	= 6	(annual interest rate)
N	= 13	(years)

CPT PMT = –$225.92 is the annual payment

Valuing Equity Securities

What is the value of a security?

- The present value of its future cash flows

Preferred and common stock

- **Preferred stock** pays a fixed dividend, assumed to be paid in perpetuity
- **Common stock** is a residual claim to a company's assets, with uncertain cash flows
- **Required return** is the discount rate used to bring future cash flows back to present values

Valuing Preferred Stock

Value preferred stock as a perpetuity

- Preferred stock pays a fixed stream of dividends
- Dividends are assumed to be infinite
- PV of a perpetuity = dividend received / required return

Example:

A company's $100 par preferred stock pays a $5.00 annual dividend. The required return is 8%. **Calculate** the value of the preferred stock.

Valuing Preferred Stock: Solution

Answer:

Value = dividend / required return
= $5.00 / 0.08
= $62.50

Valuing Common Stock

Future dividends are uncertain (three approaches):

1. Assume a constant future dividend (as with preferred stock)
2. Assume a constant growth rate of dividends
3. Assume a changing growth rate of dividends

Constant growth dividend discount model

- Also known as the Gordon growth model
- Dividends are expected to grow at a constant growth rate, g_c
- Required equity return, k_e, must be greater than g_c

Constant Growth Model

Value of a stock today (V_0)

- The *next* dividend D_1, required return k_e, constant growth rate g_c

$$V_0 = \frac{D_1}{k_e - g_c}$$

Example:

A stock is expected to pay a dividend of $1.62 next year, which is expected to grow at a constant rate of 8%, and has a required return of 12%. **Calculate** the value of the stock using the constant growth model.

Constant Growth Model: Solution

Answer:

V_0 = \$1.62 / 0.12 – 0.08

= \$40.50

Multistage Growth Model

Changing growth rates

- An initial high growth period
- A long-term constant growth rate

Example:

A stock paid a dividend of $1.00 last year. You forecast growth of 15% per year for two years, followed by constant growth of 5% indefinitely. Assuming a required return of 11%, **calculate** the value of this stock.

Multistage Growth Model: Solution

High growth period, g = 15%

- $D_1 = D_0 (1 + g)$ 1.00(1.15) = $1.15
- $D_2 = D_1 (1 + g)$ 1.15(1.15) = $1.32

Infinite constant growth, g_c = 5%

- $P_1 = D_2 / k_e - g_c$ 1.32 / 0.11 – 0.05 = $22.00

Present value, T_0

- $P_0 = (D_1 + P_1) / (1 + k_e)$ 1.15 + 22.00 / 1.11 = $20.86

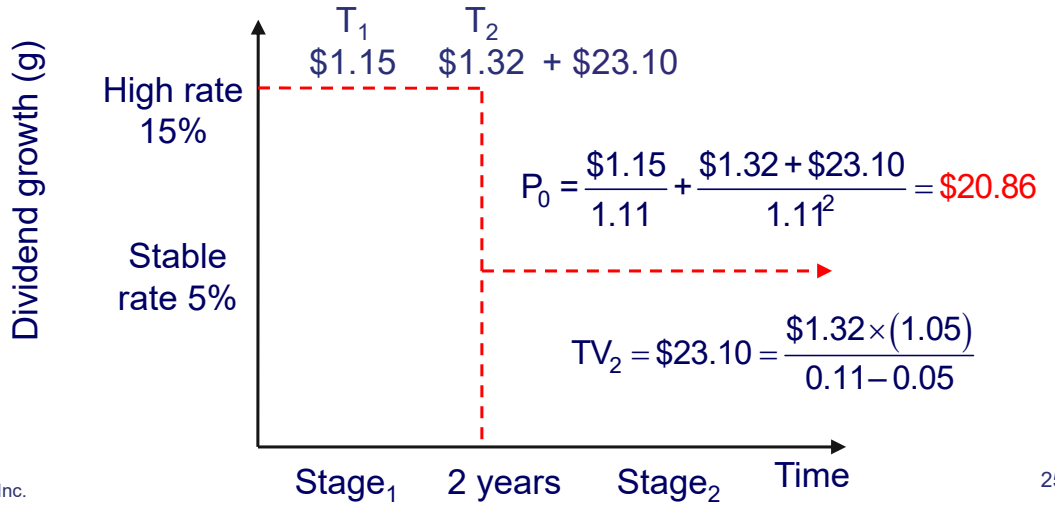
Alternative Approach

- **Methodology**:
  1. Individual estimation of supernormal dividends, *followed by…*
  2. Calculation of a terminal value
- **Note**: Very important concept

V_0 = PV(dividends over first *n* years)
+ PV(terminal value)

From Gordon growth model or price multiple approach

The Two-Stage Model: Solution



$$P_0 = \frac{\$1.15}{1.11} + \frac{\$1.32 + \$23.10}{1.11^2} = \$20.86$$

$$TV_2 = \$23.10 = \frac{\$1.32 \times (1.05)}{0.11 - 0.05}$$