Interest Rate Risk and Bond Yields

FINA 3301 Corporate Finance
Northeastern University

Kandarp Srinivasan

The standard present value equation is not as innocuous as it seems...

$$PV = \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \cdots + \frac{C_t}{(1+r)^t}$$

Does the **same** discount rate apply to both near-term cash flows as well as those farther in the future? Is this assumption justified? If not, are we over-stating the value of financial assets?

Short-term rates can be different from long-term rates

- Suppose investors discount $1 at the end of one year at 3%. Now, one could argue that $1 at the end of two years is discounted by the *same* investors at a *higher* rate, say 4%. Why?

- There are two reasons why this could happen:
  - Investors expect compensation for **interest rate risk**
  - Investors expect compensation for **inflation in the future**

In this example, 3% is called the one-year **spot rate**, and 4% is called the two-year **spot rate**.

Spot rates and yields

How are spot rates related to yields?

- Let's find the present value of $1 received at the end of both years 1 and 2, under two spot rates 3% (one-year) and 4% (two-year)

$$PV = \frac{\$1}{1 + 3\%} + \frac{\$1}{(1 + 4\%)^2}$$

$$PV = \$1.895$$

- Now we can ask, what is the single discount rate that justifies the value $1.895?

$$\$1.895 = \frac{\$1}{1 + y} + \frac{\$1}{(1 + y)^2}$$

How are spot rates related to yields?

- Solving, we get $y = 3.67\%$

- So we can think of the yield to maturity as a complex average of the spot rates. Conversely, think of spot rates as yields on zero-coupon bonds

- Although we are using a single discount rate (3.67%), we make allowance for short term and long-term rates to differ

- If we are given the spot rates for a bond, we can first calculate the bond price and then compute the yield to maturity by the procedure above.

Takeaway: In the real world, the differences in short-term and long-term spot rates will be reflected in yields of short-term and long-term bonds

What is the Yield Curve?

Treasury Yield Curve as of 2 March 2022
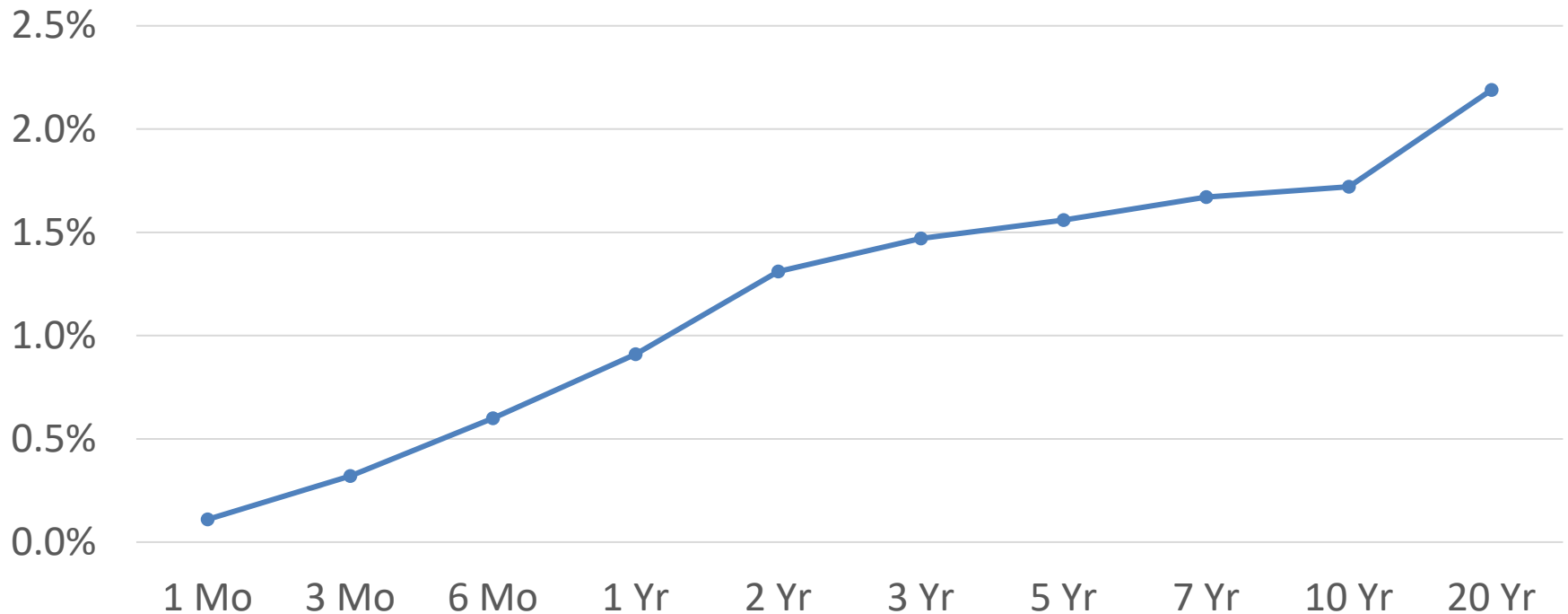
What is the yield curve?

- The plot of yields of Treasury bonds against maturities is known as the **yield curve**

- Yield curves are usually upward-sloping

- We can expect yields on long-term bonds to be higher than those of short-term bonds for two reasons:
    - Expectations of future inflation
    - Interest rate risk arising from long maturities

Why do we care?

- The yield curve reflects the combined effect of inflation expectations and a premium for bearing interest rate risk

- Since expectations of future inflation are indicators of economic growth (and central government policies), the yield curve tends to be closely watched by the market

- Some [research](#) has shown that when yield curves get inverted (i.e. long-term yields temporarily go *lower* than short-term yields), such inversions predict economic recessions

What do you expect the shape of the yield curve to be?

BONDS

10-year Treasury yield pulls back aggressively after core inflation is light in December

PUBLISHED WED, JAN 15 2025·5:11 AM EST | UPDATED 8 MIN AGO

Hakyung Kim
@IN/HAKYUNGKIM/
@HAKYUNGKIM_

Alex Harring
@ALEX_HARRING

Jenni Reid

SHARE f X in ✉

In this article

US10Y -0.129 (-2.6942%) ⊞   US2Y -0.095 (+0.1797%) ⊞

Follow your favorite stocks
CREATE FREE ACCOUNT

Prefer to List
NOW
UP NEXT

The 10-year Treasury yield ⊞ dropped Wednesday morning as investors parsed key inflation data.

The 10-year yield fell around 13 basis points to 4.663%, further pulling back from the 14-month high reached on Monday. The yield on the 2-year Treasury retreated by about 9 basis points at 4.278%.

BCG
Perso
delive
with G

One basis point is equal to 0.01%. Yields and prices move in opposite directions.

Yield Curve on 17 Jan 2025

Treasury Yield Curve as of 17 Jan 2025
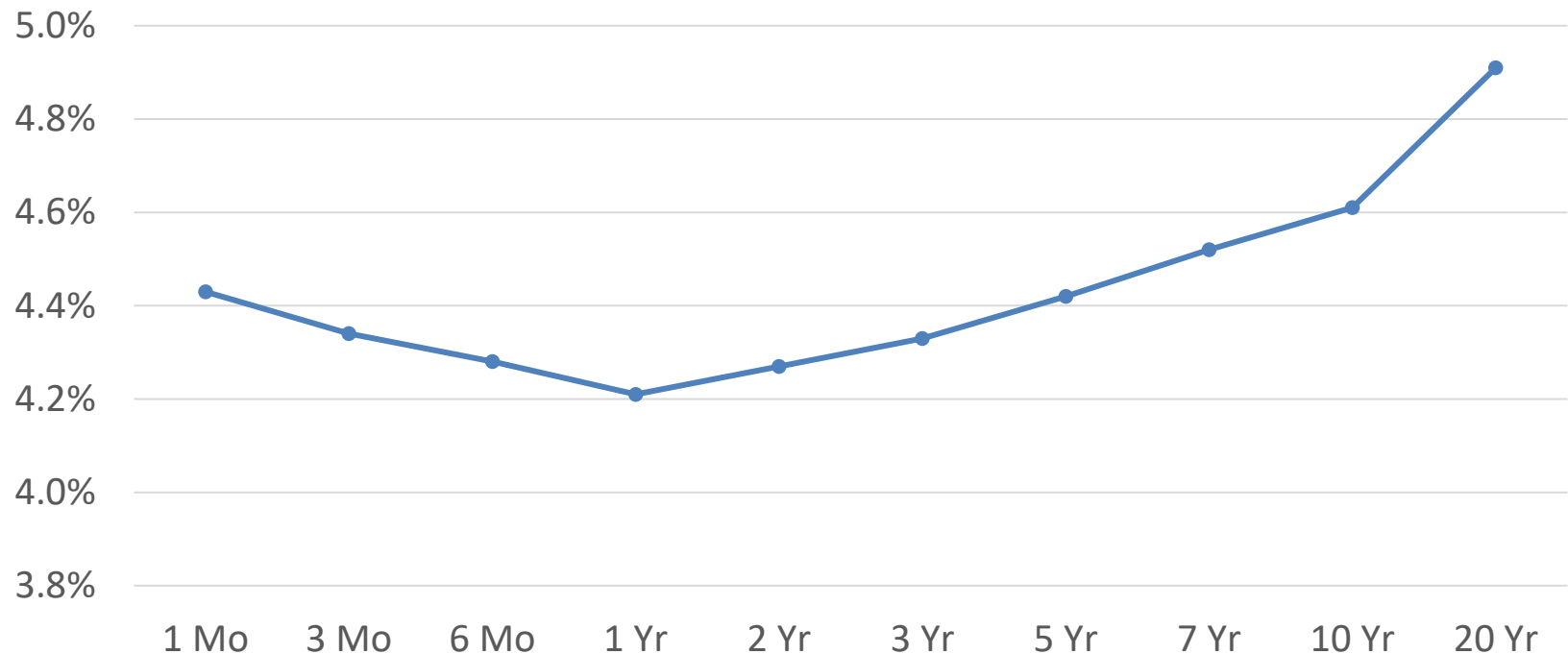
Practice

Spot rates and bond prices

Suppose you have estimated the following spot rates:

$$r_1 = 5\%, r_2 = 5.4\%, r_3 = 5.7\%, r_4 = 5.9\%, r_5 = 6\%$$

a) Calculate the price of a two-year bond with 5% annual coupon.
b) Calculate the price of a five-year bond with 10% annual coupon.

Solution

5 percent, two-year bond:

PV = $50 / 1.05 + $1,050 / 1.054^2
PV = $992.79

10 percent, five-year bond:

PV = $100 / 1.05 + $100 / 1.054^2 + $100 / 1.057^3 + $100 / 1.059^4 + $1,100 / 1.060^5

PV = $1,171.43

Stock Valuation

FINA 3301 Corporate Finance
Northeastern University

Kandarp Srinivasan

Valuation by DCF (Discounted Cash Flow)

Dividend Discount Model

- Stock price is the present value of future dividends

$$P_0 = \frac{DIV_1}{1+r_e} + \frac{DIV_2}{(1+r_e)^2} + \frac{DIV_3}{(1+r_e)^3} + \ldots$$

- Similar to bonds, we can also write:

$$r_e = \frac{DIV_1}{P_o} + \frac{P_1 - P_0}{P_o}$$

Growing Perpetuity

- If dividends are expected to grow at a constant rate of **g** from time **t+1** onwards, and g < r_e then the price of the stock at time **t** is given by:

$$P_t = \frac{DIV_{t+1}}{r_e - g}$$

- This is the PV of all dividends from time t+1 through infinity, when discounted at r_e.

Problem

A firm is expected to pay the following dividends over the next four years: $13, $9, $6, and $2.75. Afterward, the company pledges to maintain a constant 5 percent growth rate in dividends forever. If the required return on the stock is 12 percent, what is the current share price?

Solution

$P_4 = D_4 (1 + g) / (R - g)$
$P_4 = \$2.75(1.05) / (.12 - .05)$
$P_4 = \$41.25$

The price of the stock today is the PV of the first four dividends, plus the PV of the Year 4 stock price. So, the price of the stock today will be:

$P_0 = \$13 / 1.12 + \$9 / 1.12^2 + \$6 / 1.12^3 + \$2.75 / 1.12^4 + \$41.25 / 1.12^4$
$P_0 = \$51.02$

Valuation by Comparables

Problem

We want to value a large, unlisted retail firm with reported earnings of $2mn and has 1 million shares outstanding. The valuation multiples for the firm's peers are listed below. What is your estimate of the company's stock price?

Peer Company	Valuation Multiple (P/E)
Walmart	23.07
Target	15.98
Costco	31.43
Dollar Tree	27.11
Dollar General	21.66

Solution

The company reported earnings of $2mn and has 1 million shares outstanding.

Peer Company	Valuation Multiple
Walmart	23.07
Target	15.98
Costco	31.43
Dollar Tree	27.11
Dollar General	21.66
Average	**23.85**

$$Earnings\ Per\ Share\ (EPS) = \frac{\$2mn}{1mn} = \$2$$

$$Implied\ Price = \left(\frac{P}{E}\right)_{industry} * EPS = 23.85 * 2 = 47.7$$

The other common multiple used in the industry is the ratio of **Enterprise Value** to EBITDA

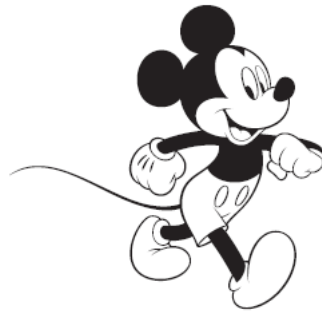# What is Enterprise Value and how do we estimate it?

$$EV = Market\ Value\ of\ a\ firm's\ operating\ assets$$

Assets	Liabilities
Cash	Equity Value
Operating Assets	Debt Value

$$EV = DebtValue + EquityValue - Cash$$

Work in a group to think of publicly traded comparables for this firm

The Walt Disney Company

The multiples approach has its challenges

Company Comp Set			
Company Name	TEV/EBITDA LTM - Latest	NTM TEV/Forward EBITDA (Capital IQ)	NTM Forward P/E (Capital IQ)
Netflix, Inc. (NasdaqGS:NFLX)	32.3x	25.88x	33.19x
Warner Bros. Discovery, Inc. (NasdaqGS:WBD)	10.3x	6.75x	NM
Comcast Corporation (NasdaqGS:CMCSA)	7.1x	7.00x	10.68x
Roku, Inc. (NasdaqGS:ROKU)	NM	150.01x	NM
Paramount Global (NasdaqGS:PARA)	11.9x	9.88x	17.87x
Fox Corporation (NasdaqGS:FOXA)	6.4x	7.16x	10.16x
Live Nation Entertainment, Inc. (NYSE:LYV)	11.7x	11.99x	46.33x
CuriosityStream Inc. (NasdaqCM:CURI)	NM	NM	NM
Warner Music Group Corp. (NasdaqGS:WMG)	18.3x	15.48x	27.13x
Spotify Technology S.A. (NYSE:SPOT)	NM	88.59x	127.75x
The Walt Disney Company (NYSE:DIS)	13.4x	12.43x	21.73x
Summary Statistics	TEV/EBITDA LTM - Latest	NTM TEV/Forward EBITDA (Capital IQ)	NTM Forward P/E (Capital IQ)
High	32.3x	150.01x	127.75x
Low	6.4x	6.75x	10.16x
Mean	14.0x	35.86x	39.02x
Median	11.7x	11.99x	27.13x

Source: S&P Capital IQ (Jan 2024)

Practice

ABC Corp just paid a dividend of $2.65 per share. The company will increase its dividend by 20 percent next year and will then reduce its dividend growth rate by 5 percentage points per year until it reaches the industry average of 5 percent dividend growth, after which the company will keep a constant growth rate forever. If the required rate of return on ABC Corp stock is 12 percent, what will a share of stock sell today?

Solution

Here we have a stock whose dividend growth changes every year for the first four years. We can find the price of the stock in Year 3 since the dividend growth rate is constant after the third dividend. The price of the stock in Year 3 will be the dividend in Year 4, divided by the required return minus the constant dividend growth rate. So, the price in Year 3 will be:

$P_3 = \$2.65(1.20)(1.15)(1.10)(1.05) / (.12 - .05)$
$P_3 = \$60.34$

The price of the stock today will be the PV of the first three dividends, plus the PV of the stock price in Year 3, so:

$P_0 = \$2.65(1.20)/(1.12) + \$2.65(1.20)(1.15)/1.12^2 + \$2.65(1.20)(1.15)(1.10)/1.12^3 + \$60.34/1.12^3$

$P_0 = \$51.57$

Problem

The stock of Northwest Natural Gas is selling for $49.43 per share in the beginning of 2022. Dividend next year is expected at $2 a share. Analysts who are following Northwest are forecasting an annual growth of 7.7%. What is your best estimate of the company's cost of equity capital?

Solve for r_e in this dividend growth model:

$$P_0 = \frac{DIV_1}{r_e - g}$$

$$r_e = \frac{DIV_1}{P_0} + g = \frac{2}{49.43} + 7.7\% = 11.8\%$$