

# FIN2010 Financial Management

## The Valuation of Long-Term Securities

### -Stock Valuation



# Agenda

- Stock pricing overview
- Method 1: dividend discount model
- Method 2: comparable pricing
- Method 3: discounted free cash flow model
- Final word



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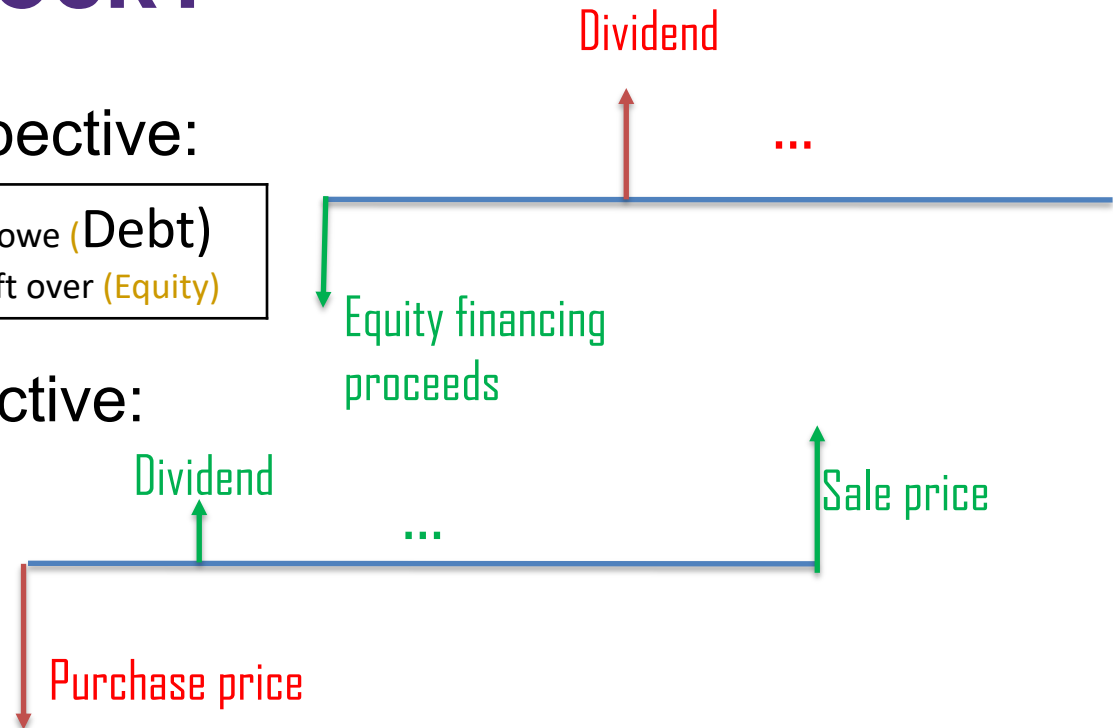
# What is a Stock?

- Corporate's perspective:

What we own (Asset)	What we owe (Debt) What is left over (Equity)
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- Investor's perspective:

- Cash flow:



- Rights: vote, claim to dividend
- What do I have no control of?
  - Cannot make day-to-day decisions
  - Cannot force the company to pay dividends



# Stock Valuation—Overview

- Key: predicting unknown cash flows in the future and determining required return
  - Discounted dividend model: forecast what dividend investors will get
  - Discounted free cash flow model: forecast how much a firm can earn (free cash flow)
  - Comparable pricing: use the prices of comparable firms
- But predicting the future is hard! No one can accurately predict the future. As an investor or financial analyst, we can only try our best.




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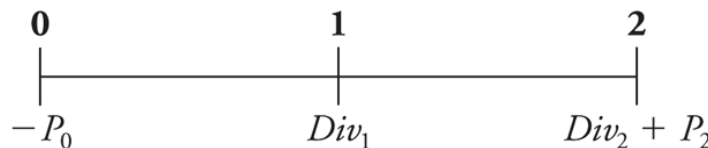


# The Dividend Discount Model

- What is a stock's value if we plan to hold the stock for one year?


$$P_0 = \left( \frac{Div_1 + P_1}{1 + r_E} \right)$$

- What is a stock's value if we plan to hold the stock for two years?


$$P_0 = \frac{Div_1}{1 + r_E} + \frac{Div_2 + P_2}{(1 + r_E)^2}$$

– $r_E$ : discount rate. Also called required rate of return from equity or cost of equity in stock valuation



# The Dividend Discount Model

- What if you plan to hold the stock for N years?

$$P_0 = \frac{Div_1}{1 + r_E} + \frac{Div_2}{(1 + r_E)^2} + \dots + \frac{Div_N}{(1 + r_E)^N} + \frac{P_N}{(1 + r_E)^N}$$

- In cases when a firm is expected to operate forever, we can let N go to infinity and write it as follows:

$$P_0 = \frac{Div_1}{1 + r_E} + \frac{Div_2}{(1 + r_E)^2} + \frac{Div_3}{(1 + r_E)^3} + \dots = \sum_{n=1}^{\infty} \frac{Div_n}{(1 + r_E)^n}$$

- *The price of any stock is equal to the present value of the expected future dividends it will pay.*





# The Dividend Discount Model

- The challenge: virtually impossible to forecast an infinite number of dividends
  - Therefore, we tend to make **simplified assumptions** about the future dividends
- Based on the assumptions we make, the DDM is classified into three categories:
  - ***Zero growth model***: dividends are constant over time
  - ***Constant growth model***: dividends grow at a constant rate
  - ***Variable growth model***: dividends change for a number of years and then stabilize to a sustainable growth rate



# Zero Growth Model

Zero growth model: the firm's future dividends will be a constant number forever.



- Zero Growth stock is a perpetuity:  $P_0 = Div / r_E$   
Where  $r_E$  is the required return on equity



# Example – Zero Growth Model

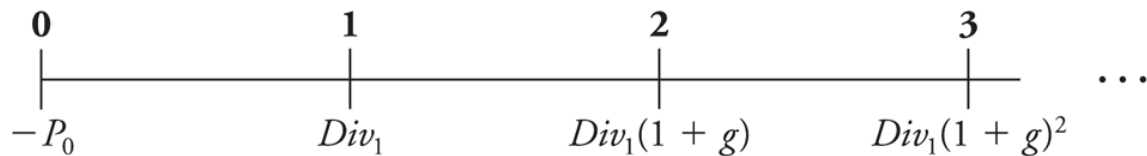
Suppose you are thinking of purchasing the stock of Moore Oil, Inc. You expect the stock to pay a \$0.50 dividend every quarter and the required return is 10% per year. What is the price?

$$P_0 = .50 / (10\% / 4) = \$20$$



# Constant Growth Model

- Constant Dividend Growth: the firm's future dividends will grow at a constant rate,  $g$ , forever



$$P_0 = \frac{Div_1}{r_E - g}$$

- The value of the firm depends on the current dividend level, the cost of equity, and the growth rate
- Insights:
  - $g \uparrow$ , price  $\uparrow$       Firms with higher growth potential have higher stock value
  - $r_E \uparrow$ , price  $\downarrow$       When investors demand higher return, a stock has lower stock value. Investors often demand higher return for riskier stock.



# Example – Constant Growth Model

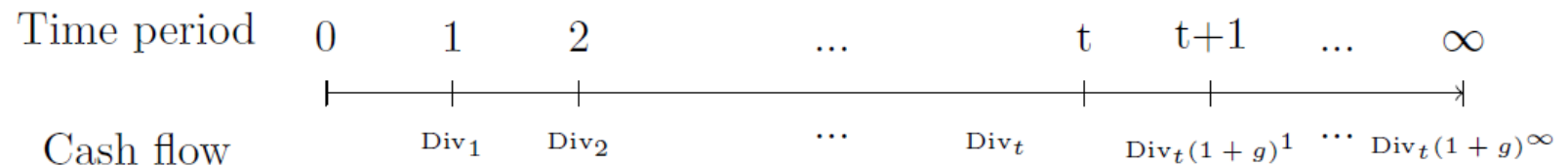
- Consolidated Edison, Inc. is a regulated utility company that services the New York City area. Suppose Con Edison plans to pay \$2.60 per share in dividends in the coming year. If its equity cost of capital is 6% and dividends are expected to grow by 2% per year in the future, estimate the value of Con Edison's stock.

$$P_0 = \frac{Div_1}{r_e - g} = \frac{2.6}{6\% - 2\%} = \$65$$



# Variable Growth Model

- Dividend is unstable in the first stage, and then it grows at a sustainable constant rate in the second stage.



Value of stock = PV of dividend in the 1st stage + PV of dividend in the 2nd stage.

$$= \frac{\text{Div}_1}{1+r} + \frac{\text{Div}_2}{(1+r)^2} + \dots + \frac{\text{Div}_t}{(1+r)^t} + \frac{\frac{\text{Div}_t(1+g)}{r-g}}{(1+r)^t}$$



# Example – Discounted Dividend Model

- Example: Assume that there are 3 companies, and they all just paid exactly the same annual dividend of \$2.25 a share. In addition, the future annual rate of growth in dividends for each of the 3 companies has been estimated as follows. What are the fair prices if the discount rate is 10%?

Firm A	Firm B	Firm C	
$g=0$	$g=6\%$	Year 1	\$2.53
i.e., dividends are expected to remain at \$2.25/share	for the foreseeable future	Year 2	\$2.85
		Year 3	\$3.20
		Year 4	\$3.60
		Year 5 and beyond	$g=6\%$

## Solution:

- Firm A: value =  $\frac{2.25}{10\%} = 22.5$
- Firm B: value =  $\frac{2.25 * (1+6\%)}{10\% - 6\%} = 59.63$
- Firm C: value =  $\frac{2.53}{(1+10\%)^1} + \frac{2.85}{(1+10\%)^2} + \frac{3.2}{(1+10\%)^3} + \frac{3.6}{(1+10\%)^4} + \frac{3.6 * (1+6\%)}{(10\% - 6\%) * (1+10\%)^4} = 74.68$



# Which Model to Choose?

## *Zero growth model :*

- Generally used to price preferred stock

## *Variable growth model:*

- Appropriate for companies expected to experience rapid or variable rates of growth for a period and then settle down to a more stable growth rate thereafter
- This, in fact, is the growth pattern of many young companies, so the model has considerable application in practice.

## *The constant-growth model:*

- Best suited for common stocks of mature, dividend-paying companies
- They are probably large companies (or even some mature mid-cap 中等市值的公司 companies) that have demonstrated an ability to generate steady rates of growth. capitalization
- The growth rates may not be identical from year to year, but they tend to move within a relatively narrow range.





# What is the Appropriate $g$ ?

- The math in dividend discount model is easy. Real life is complicated.
- Biggest challenge: how to determine  $div$ ,  $r_E$ ,  $g$
- Will discuss in depth how to determine  $r_E$  and  $div$  in future lectures.
- Here we briefly discuss a simple model of  $g$  and try to get a sense of what is driving stock price



# Dividend Growth Rate

- **Method 1:** Calculate the growth rate of dividends in the past. Shortcoming: backward looking.
- **Method 2:** look at the key forces that actually drive the  $g$ . One commonly used approach:
  - Assumption: the ROE (return on equity) and the dividend payout ratio ( $b$ ) are constant. Retention ratio ( $rr$ ) =  $1 - \text{payout ratio } (b)$

$$\begin{aligned}\text{Dividend growth}(g) &= \frac{\text{Div}_{t+1} - \text{Div}_t}{\text{Div}_t} \\ &= \frac{\text{ROE} * \text{Equity}_{t+1} * b - \text{ROE} * \text{Equity}_t * b}{\text{ROE} * \text{Equity}_t * b} \\ &= \frac{\text{Equity}_{t+1} - \text{Equity}_t}{\text{Equity}_t} \\ &= \frac{\text{Equity}_t + \text{Equity}_t * \text{ROE} * (1 - b) - \text{Equity}_t}{\text{Equity}_t} \\ &= \text{ROE} * (1 - b) \\ &= \text{ROE} * rr\end{aligned}$$

$$g = \text{ROE} * (1 - b) = \text{ROE} * rr$$



# Insights from the Simple Model

- Applying the simple model of  $g$  into constant growth model generate some great insights:

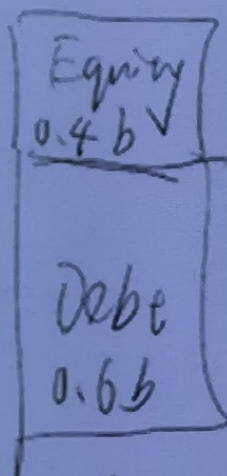
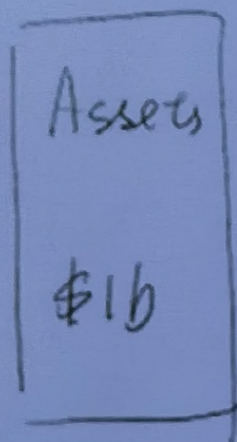
$$P_0 = \frac{Div_1}{r_e - g} = \frac{ROE * Equity * (1 - rr)}{r_e - ROE * rr}$$

- Higher ROE, higher stock price. Profitable firms' stock have higher values.
- How does  $rr$  affect stock value?

$$\frac{\partial P}{\partial rr} = \frac{ROE * Equity (ROE - r_e)}{[r_e - ROE * rr]^2}$$

- The answer will depend on the profitability of the firm's investments
  - When  $ROE > r_e$ , higher retention ratio leads to higher stock value.
  - When  $ROE < r_e$ , higher  $rr$  leads to lower stock value.
- ROE: the return firms earn on the amount they reinvest into the business (retained earnings).  $r_e$ : investors' required return.
- Overall, increasing efficient investment leads to stock value increase.
  - Efficient (inefficient) investment: when ROE is higher (lower) than investors' required return.





$$rr = 1 - b$$


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$$rr + b = 1$$

$NF = \$0.1b$ 

 retained earning (\$0.06b)  
 dividend (\$0.04b)  
 0.1b
 

 retention ratio =  $\frac{0.06}{0.1} = 60\%$   
 payout ratio =  $\frac{0.04}{0.1} = 40\%$

Return on assets =  $\frac{\$0.1b}{\$1b} = \underline{10\%}$   
 (ROA)

Return on equity =  $\frac{0.1b}{0.4b} = 25\%$   
 (ROE)

# Limitations of the Dividend Discount Model

- Cannot be used on stocks that do not pay dividends
- Div,  $r$  and  $g$  can only be estimated with error
- Results are extremely sensitive to  $r$  and  $g$  (small changes in  $r$  and  $g$  can lead to large changes in the estimated stock price)
- Forecasting  $g$  requires forecasting the ROE and dividend payout rate, which could be hard to predict



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# Method of Comparable

- We estimate the value of the firm based on the value of other comparable firms
- Another application of the Law of One Price: similar stocks should be price similarly
- Similar firms: similar in future growth and risk. One sensible but not perfect way to look for similar firm:
  - Same industry
  - Similar size and maturity level



# Method of Comparable- Valuation multiples

- Stock shares do not have the same unit
  - Two firms are both worth \$100M:
    - (1) Firm A issued 1M shares, so each share is worth \$100
    - (2) Firm B issued 10M shares, so each share is worth \$10?
    - (3) Just because firm A's stock is \$100/share, we believe firm B's stock should also be \$100/share would be wrong.
- To adjust for the differences in scale, we calculate the share value in terms of a **valuation multiple**
  - By buying stocks, we earn rights to claim for the firms' future profit.
  - Stock value = rights \* value / rights
  - *Analogous to:*
  - House value = size (# of square meters) \* value/square meter





# Valuation Multiples

- Most commonly used **model**:
  - Stock's fair value =  $\text{EPS} \times \text{appropriate P/E ratio}$
  - Earnings per share (EPS) =  $\frac{\text{Net income}}{\text{\# of shares}}$
  - P/E Ratio (市盈率): the multiple
    - Appropriate P/E ratio: often use similar firms' actual P/E ratio.
- Other commonly used valuation multiples
  - Stock's fair value = cash flow per share \* appropriate price/cash flow per share
  - Stock's fair value = sales per share \* appropriate price/sales per share  
*PS ratio 市销率*
  - Stock's fair value = book value per share \* appropriate price/book value per share



# Example-Valuation Multiples

- Suppose furniture manufacturer Herman Miller, Inc., has earnings per share of \$1.38. If the average P/E of comparable furniture stocks is 21.3, estimate a value for Herman Miller using the P/E as a valuation multiple. What are the assumptions underlying this estimate?
- Solution:  $P_0 = \$1.38 * 21.3 = \$29.39$
- Underlying assumptions: Herman Miller is similar to an average firm in the industry



# Actual and appropriate P/E ratio

- Just like every stock has a market price, and every investor have her own fair value in mind.
- A stock has an actual P/E ratio, and every investor may have her own fair P/E ratio in mind.
  - Actual P/E ratio=market price/EPS.
  - Fair price=EPS\*appropriate P/E ratio
    - We often use other stock's actual P/E as the focal stock's appropriate P/E ratio.



# What Determines P/E ratio?

- Let's dig deeper into P/E ratio with the constant growth model.

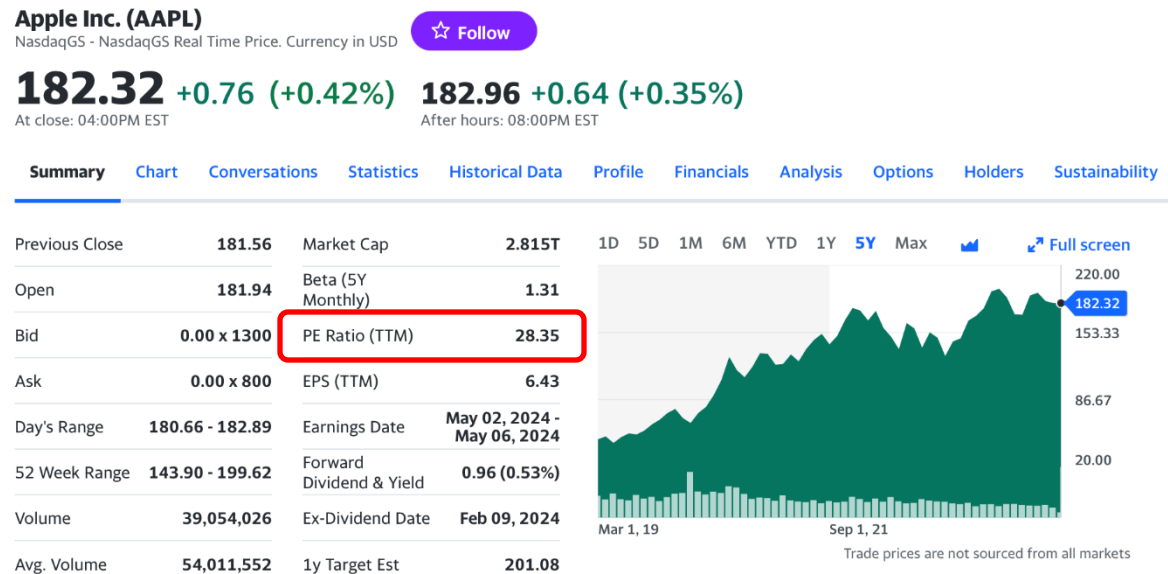
$$- P = \frac{div}{r-g} \rightarrow \frac{P}{E} = \frac{div}{(r-g)*E}$$

- Although the constant growth model is not a perfect model, it provides great insights into the determinants of P/E ratio.
- Therefore, investors typically value firms with lower risk and higher growth rate at higher P/E ratio.
  - We will learn in the future topics that investors' required returns are positively related to the perceived risk in an investment. Higher risk, higher required return.



# Where can We Find P/E Ratios?

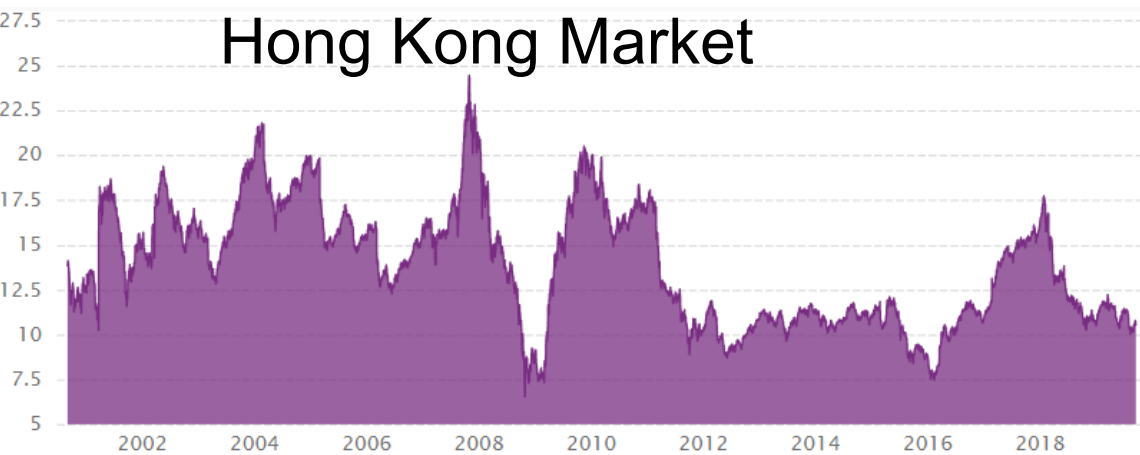
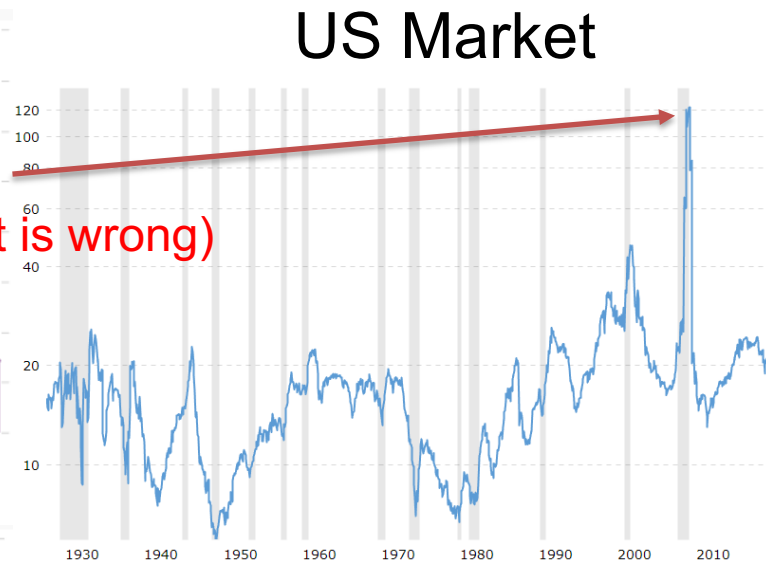
- Yahoo Finance:  
[Apple Inc.](#)



- Sina Finance:  
[贵州茅台](#)



# Historical P/E Ratios of Different Markets



# Limitations of Comparable Pricing Method

- There is no clear guidance on how to
  - Choose similar firms
  - Adjust for differences in expected future growth rates, risk, or differences in accounting policies
- This method values a firm relative to similar firms in the market. However, the similar firms may be wrongly priced themselves, which may lead to a wrong valuation of the targeted firm
  - In contrast, discounted dividend model have the advantage that they can incorporate specific information about the firm's cost of capital or future growth



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# Discounted Free Cash Flow Model

*(We will discuss this in detail in the 2<sup>nd</sup> half of the semester)*

- Intuition: **enterprise value = PV(free cash flow of the firm)**
  - Enterprise value = equity value + debt value – cash →
    - Equity value = enterprise value + cash – debt value
  - Logic: the cash generated by a firm can be paid out as dividends (although its manager may decide not to).
- Pros:
  - Very flexible. Can be used to analyze any firm (esp. for startups, which are difficult to value using the other 2 methods).
  - Can justify any price
- Cons:
  - Need to make a LOT of assumptions, which might be difficult to justify.



# DFCF Model Example

- [Aswath Damodaran's valuation of Tesla](#)

	<i>Base year</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>
Revenue growth rate		70.00%	70.00%	70.00%	70.00%	70.00%	56.55%
Revenues	\$ 1,328.70	\$ 2,258.78	\$ 3,839.93	\$ 6,527.88	\$ 11,097.40	\$ 18,865.58	\$ 29,534.07
EBIT (Operating) margin	-1.64%	-0.23%	1.18%	2.60%	4.01%	5.43%	6.84%
EBIT (Operating income)	\$ (21.86)	\$ (5.21)	\$ 45.46	\$ 169.63	\$ 445.34	\$ 1,023.93	\$ 2,020.72
Tax rate	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	7.00%
EBIT(1-t)	\$ (21.86)	\$ (5.21)	\$ 45.46	\$ 169.63	\$ 445.34	\$ 1,023.93	\$ 1,879.27
- Reinvestment		\$ 659.64	\$ 1,121.38	\$ 1,906.35	\$ 3,240.79	\$ 5,509.35	\$ 7,566.30
FCFF		\$ (664.84)	\$ (1,075.92)	\$ (1,736.72)	\$ (2,795.45)	\$ (4,485.42)	\$ (5,687.03)
NOL	\$ 1,070.00	\$ 1,075.21	\$ 1,029.74	\$ 860.11	\$ 414.78	\$ -	\$ -
Cost of capital		10.03%	10.03%	10.03%	10.03%	10.03%	9.63%
Cumulated discount factor		0.9088	0.8260	0.7507	0.6822	0.6200	0.5656
PV(FCFF)		\$ (604.23)	\$ (888.67)	\$ (1,303.68)	\$ (1,907.10)	\$ (2,781.02)	\$ (3,216.43)



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# Stock Valuation Techniques: The Final Word

- No single technique provides a final answer regarding a stock's true value. All approaches require assumptions or forecasts that are too uncertain to provide a definitive assessment of the firm's value.
  - Most real-world practitioners use a combination of these approaches and gain confidence if the results are consistent across a variety of methods
  - Other methods: total payout model, dividend and earnings approach
  - Additional analysis: sensitivity analysis, scenario analysis...



# A Glimpse at an Analysts' Report

- <https://www.cfainstitute.org/en/societies/challenge/past-champions>

## Financial Model – Base Case

### Canadian Tire Retail

#### INCOME STATEMENT

Revenue from Stores Opened 2014 and Prior

Revenue from New Stores ('15E - '20E)

Revenue

Cost of Goods Sold

Gross Margin

Selling, General, and Administrative (excl. D&A)

Depreciation and Amortization

EBIT

Taxes

Unlevered Net Income

EBITDA

#### FREE CASH FLOW SCHEDULE

Unlevered Net Income

Add: Depreciation and Amortization

Less: Capital Expenditures

Less: Change in Net Working Capital

Unlevered Free Cash Flow

Terminal Growth Rate

Terminal Value

WACC (Diversified Retail)

Present Value Factor (Mid-Year Convention)

PV of Unlevered Free Cash Flow

Implied Enterprise Value

## Appendix A3: FGL Terminal Multiple Assumptions

The terminal multiple for FGL was determined through a 10-year trading multiples analysis of comparable companies in the sporting goods retailing subsector. The global median (second quartile) of the 10-year trading multiples analysis was used as the terminal multiple. The chosen competitor set included: Foot Locker, Inc., Cabela's Incorporated, Dick's Sporting Goods Inc., Sportman's Warehouse Holdings, Inc., and Hibbett Sports, Inc.

Historical EV / EBITDA Trend: Sporting Goods and Apparel Retailers



- Source: written report of the 2016 champion



# Analysts Often Disagree with Each Other!

- Analysts' price targets of [Tesla Inc.](#)

Date	Brokerage	Action	Rating	Price Target
2/11/2019	Canaccord Genuity	Upgrade	Hold → Buy	\$330.00 → \$450.00
2/6/2019	Royal Bank of Canada	Reiterated Rating	Sell	\$245.00
2/5/2019	Morgan Stanley	Reiterated Rating	Equal → Equal Weight	\$291.00 → \$283.00
2/4/2019	DZ Bank	Reiterated Rating	Sell	
1/31/2019	CIBC	Reiterated Rating	Outperform → Outperform	\$418.00 → \$437.00
1/31/2019	JPMorgan Chase & Co.	Reiterated Rating	Underweight → Underweight	\$220.00 → \$230.00
1/31/2019	JMP Securities	Reiterated Rating	Mkt Outperform → Outperform	\$408.00 → \$406.00
1/31/2019	Jefferies Financial Group	Set Price Target	Buy	\$450.00



# Why are We Learning This?

- The purpose of the lecture is not
  - To teach you how to make accurate forecasts so you can get rich
- But rather, the purpose is to get you familiar with the techniques so you are able to
  - Understand the assumptions and flaws of the pricing models
  - Know how to use these models based on your forecasts.
  - Be able to draw insights from the models even though they are flawed
  - Understand the news/reports
  - Take more advanced finance courses
  - Think critically



# Summary

- Three commonly used methods to price stocks
  - Dividend discount model
  - Method of comparable pricing
  - Discounted free cash flow model
- No single method is perfect.
  - We typically use a combination of different methods in reality.
  - Analysts disagree with each other all the time.

