Lecture 3. Stocks

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Course Outline

- **Introduction to stocks**

- Stock valuations
  - Dividend discount model
  - A special case: Gordon growth model
  - Extensions

- Implications of the stock valuation model
  - Factors that can move stock prices
  - Factors that can affect stock returns

What is a Stock?

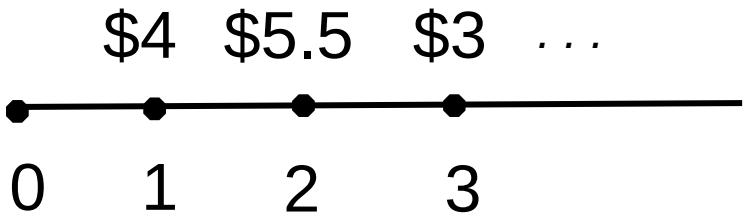
- Stock represents an ownership in a company.
  - Stock holders (shareholders) own the firm, and they hire managers (e.g., CEO) to make decisions that maximize the firm value.

- The company distributes part of its earnings as **dividends** to shareholders if it is deemed in the best interest of the shareholders.

- Stocks are valuable because of future dividends.

What is the Cash Flow of a Stock?

- The stream of uncertain dividends is the cash flow from holding a stock.



- Alternatively, you can think of your cash flows as the stream of dividends and the price at which you will sell the stock.

Types of Stocks

- Common stock
  - Carries voting rights
  - Low priority in receiving dividend payments (preferred stock holders paid first).

- Preferred stock
  - Does not carry voting rights
  - High priority in receiving dividend payments.

How Are Stocks Traded?

- **Initial public offerings** (IPO)
  - Initial sale of shares by the company to the public (institutional + retail investors)
  - Also known as “going public”
  - “Underwritten” by investment banks

- **Seasoned equity offerings** (SEO)
  - New issuance of equity shares of a company that has done an IPO in the past.

- **Secondary market** (what people usually mean when they say “**stock market**” or “**equity market**”)
  - Buying & selling existing shares

IPOs in 2022

reddit

And many others:
https://www.marketwatch.com/tools/ipo-calendar

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Stock Valuation: Dividend Discount Model

- **Dividend Discount Model** ("**DDM**") (also called a "discounted cash flow" or "DCF" model): Today's stock price equals the present value of all expected future dividends.

$$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \ldots + \frac{D_T}{(1+r)^T} + \ldots$$

$$= \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t}$$

Stock Valuation: Dividend Discount Model

- Question: If you plan to sell the stock after a few years, you won't get all the dividends. Is the DDM still valid? Yes.

- Suppose you hold a stock for 1 year and sell it for P_1. Then, the present value logic says,

$$P_0 = \frac{D_1 + P_1}{1+r}$$

- But what is P_1? Can think of it as holding the stock from year 1 to year 2 and selling it for P_2:

$$P_1 = \frac{D_2 + P_2}{1+r}$$

- So then,

$$P_0 = \frac{D_1 + P_1}{1+r} = \frac{D_1 + (D_2 + P_2)/(1+r)}{1+r} = \frac{D_1}{1+r} + \frac{D_2 + P_2}{(1+r)^2}$$

Stock Valuation: Dividend Discount Model

- Continuing this logic, we find

$$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \ldots + \frac{D_T}{(1+r)^T} + \ldots$$

- So to find the current price, you can either use

$$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \ldots + \frac{D_T + P_T}{(1+r)^T}$$

or

$$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \ldots + \frac{D_T}{(1+r)^T} + \ldots$$

Stock Valuation: DDM

Example

Current forecasts are for Coca-Cola (KO) to pay dividends of £50, £52, and £55 over the next three years. At the end of three years you anticipate selling your stock at a market price of £1,100. What is the current price of the stock given a 6% discount rate?

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Stock Valuation: Gordon Growth Model

- **Gordon growth model** ("**GGM**"): A special case of the DDM where dividend grows at a constant rate *g*. If $D_{t+1} = (1+g)D_t$,

$$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \ldots + \frac{D_T}{(1+r)^T} + \ldots$$

$$P_0 = \frac{D_1}{1+r} + \frac{D_1(1+g)}{(1+r)^2} + \frac{D_1(1+g)^2}{(1+r)^3} + \ldots + \frac{D_1(1+g)^{T-1}}{(1+r)^T} + \ldots$$

$$= \frac{D_1}{r-g}$$

Stock Valuation: GGM

Example

If a stock with a discount rate 12% is selling for $100 in the stock market and dividend will be $3 next year, what is the growth rate of dividends that the market is assuming?

You can also combine the more typical DDM with GGM. For instance, suppose that a stock with a 12% discount rate will pay $3 next year, after which the dividend grows by 5% every year until year 4, when the dividend growth slows down to be around 2%. What's the price today?

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Extension 1: The Role of Earnings

- Ultimately dividends come from earnings, so we can relate the value of a stock to its earnings.

- A quick overview of accounting quantities
  - **Assets**: Value of the plant and machinery, inventories of materials, cash in bank
  - **Liabilities**: Money owed to banks and bond holders, taxes to be paid, etc
  - **Book value of equity** = assets – liabilities
    - **Book value per share (BVPS)** = book value of equity / number of shares outstanding
  - **Earnings**: Profits over a year
    - **Earnings per share (EPS)** = earnings / number of shares outstanding
  - **Return on equity (ROE)** = earnings / book equity = EPS / BVPS
  - **Plowback ratio**: Share of earnings retained & reinvested into book equity. Plowback ratio b = (EPS – Dividend) / EPS

Extension 1: The Role of Earnings

Example: Fill in the shaded blanks.

	Year -1	Year 0	Year 1
(1) ROE		10%	10%
(2) Plowback ratio *b*		80%	80%
(3) Earnings = $(6)_{last} \times (1)_{this}$			
(4) Dividend = [1-(2)] × (3)			
(5) Retained earnings = (2) × (3)			
(6) BVPS = $(6)_{last} + (5)_{this}$	100		
(7) Earnings growth rate = (3) / $(3)_{last}$ – 1			
(8) Dividend growth rate = (4) / $(4)_{last}$ – 1			

Extension 1: The Role of Earnings

	Year -1	Year 0	Year 1
(1) ROE		10%	10%
(2) Plowback ratio *b*		80%	80%
(3) Earnings = $(6)_{last} \times (1)_{this}$		10	10.8
(4) Dividend = [1-(2)] × (3)		2	2.16
(5) Retained earnings = (2) × (3)		8	8.64
(6) BVPS = $(6)_{last} + (5)_{this}$	100	108	116.64
(7) Earnings growth rate = (3) / $(3)_{last} - 1$			8%
(8) Dividend growth rate = (4) / $(4)_{last} - 1$			8%

Extension 1: The Role of Earnings

- From the example, you see that

dividend growth rate (*g*) = earnings growth rate
= plowback ratio x ROE

- Why? $$\frac{D_t}{D_{t-1}} - 1 = \frac{(1-b) \times EPS_t}{(1-b) \times EPS_{t-1}} - 1 = \frac{EPS_t}{EPS_{t-1}} - 1 = \frac{ROE \times BVPS_t}{ROE \times BVPS_{t-1}} - 1$$
$$= \frac{BVPS_t}{BVPS_{t-1}} - 1 = \frac{(1 + b \times ROE)BVPS_{t-1}}{BVPS_{t-1}} - 1 = b \times ROE$$

- Here, it may seem like a higher plowback ratio is always good for the stock. This is not case; a higher plowback ratio reduces today's dividend.

Extension 1: The Role of Earnings

Example**:** Suppose PEP is expected to have an EPS next year of $5 and ROE is 20%. If the discount rate is 8% and plowback ratio is 0.2, what is the fair price of PEP today? (Assume that the ROE and plowback ratio are constant over time.)

Extension 1: The Role of Earnings

Example: Suppose PEP is expected to have an EPS next year of $5 and ROE is 20%. If the discount rate is 8% and plowback ratio is 0.2, what is the fair price of PEP today? (Assume that the ROE and plowback ratio are constant over time.)

Gordon growth model: $$P_0 = \frac{D_1}{r-g} = \frac{(1-b)\times EPS_1}{r-b\times ROE}$$

(where *b* is the plowback ratio). Hence,

$$P_0 = \frac{0.8\times 5}{0.08-0.2\times 0.2} = \frac{4}{0.04} = \$100$$

Extension 2: Varying Growth Rates

Example**:** Everything is the same except the earnings will growth at 10% from next year for two years, after which the earnings growth rate stabilizes to plowback ratio times ROE. What is the fair price of PEP today?

Extension 2: Varying Growth Rates

Example: Everything is the same except the earnings will grow at 10% from next year for two years, after which the earnings growth rate stabilizes to 4%. What is the fair price of PEP today?

$$P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3 + P_3}{(1+r)^3}$$

$$= \frac{(1-0.2)5}{1.08} + \frac{(1-0.2)\times 1.1\times 5}{(1.08)^2}$$

$$+ \frac{(1-0.2)(1.1)^2 5(1+1.04/(0.08-0.04)}{(1.08)^3}$$

$$= 111.2$$

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Factors that Can Move Stock Prices

- Gordon growth model implies:

$$\frac{P_0}{D_0} = \frac{1+g}{r-g}$$

where *g* is expected growth of earnings and

r = risk-free rate + risk premium

= risk-free rate + (amount of risk)(risk aversion)

- So, 4 reasons stock price can change (under rationality assumption):
  - (1) changes in forecasted earnings
  - (2) changes in forecasted future risk-free rate
  - (3) changes in forecasted future risk
  - (4) changes in investor risk aversion

Factors that Can Move Stock Prices

- Shiller (1981): Most of the variation in the aggregate stock market price is due to changes in investor risk aversion.

  ~~(1) changes in forecasted earnings~~

  * To be precise, (1) does occur (Campbell, 1991) but it's small compared to (4)

  ~~(2) changes in forecasted future risk-free rate~~

  ~~(3) changes in forecasted future risk~~

  (4) changes in investor risk aversion

Factors that Can Affect Stock Returns

- Return on a stock:

$$R = \frac{D_1 + P_1 - P_0}{P_0}$$

D is dividend and *P* is price.

- Example: *Apple (AAPL) is selling for $150 today and expected to sell for $160 one year from now. What is the expected return if the dividend one year from now is forecasted to be $5?*

Factors that Can Affect Stock Returns

Candidate 1: Expected earnings growth

- Consider two companies with the same riskiness but different earnings growth rate
  - Company A: $r = 10\%$, $g = 5\%$
  - Company B: $r = 10\%$, $g = 8\%$

- Does the company with a higher earnings growth generate a higher return?

Factors that Can Affect Stock Returns

- Consider two companies with the same riskiness but different earnings growth rate
  - Company A: r = 10%, g = 5%
  - Company B: r = 10%, g = 8%

- Does the company with a higher earnings growth generate a higher return? No, both companies will generate a return of 10%.

$$R = \frac{D_1 + P_1}{P_0} - 1 = \frac{(1+g)D_0 + (1+g)^2 D_0/(r-g)}{D_1/(r-g)} - 1 = r$$

- The reason is that the higher earnings growth has already been taken into account in P_0. So in an efficient market, **expected return** depends only on the stock's riskiness.

Factors that Can Affect Stock Returns

Candidate 2: Unexpected change in future earnings growth

- Consider a company whose expected future earnings growth changes from g in year 0 to $g_{new} > g$ in year 1. How does the return compare to the discount rate r?

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- Consider a company whose expected future earnings growth changes from g in year 0 to $g_{new} > g$ in year 1. How does the return compare to the discount rate r?

- Stock return from year 0 to year 1 is higher than the discount rate.

$$R = \frac{D_1 + P_1}{P_0} - 1 = \frac{(1+g)D_0 + (1+g)(1+g_{new})D_0/(r-g_{new})}{(1+g)D_0/(r-g)} - 1$$

$$= (1+r)\frac{r-g}{r-g_{new}} - 1 > r$$

Factors that Can Affect Stock Returns

Candidate 3: Unexpected change in the discount rate

- Consider a company whose discount rate changes from r in year 0 to $r_{new} > r$ in year 1. How does the return compare to the discount rate r?

Factors that Can Affect Stock Returns

Candidate 3: Unexpected change in the discount rate

- Consider a company whose discount rate changes from r in year 0 to $r_{new} > r$ in year 1. How does the return compare to the discount rate r?

- Stock return from year 0 to year 1 is lower than the discount rate.

$$R = \frac{D_1 + P_1}{P_0} - 1 = \frac{(1+g)D_0 + (1+g)^2 D_0/(r_{new} - g)}{(1+g)D_0/(r-g)} - 1$$

$$= r + \left(\frac{r-g}{r_{new} - g} - 1 \right)(1+g) < r$$