

Theory of stock market

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Agendas

- Stock valuation techniques
- The equilibrium required rate of return: CAPM
- Behavior of stock prices (in another separate lecture slide)

Shareholders' right

- Owner of a common stock is considered as a shareholder of the company/corporation.
- What does the investor yield from holding a common stock?

Answer: Right to claim on dividend pay-out by firms/corporations.

Valuation of risky cash flow asset

- Principle of valuation revisited:

$$\begin{aligned} P_0 &= V_0 \\ &= \frac{E(CF_1)}{1+r} + \frac{E(CF_2)}{(1+r)^2} + \dots + \frac{E(CF_T)}{(1+r)^T} + \dots \end{aligned}$$

- $E[*]$ = Expected of cash-flow delivered at time t.
- r = risk-adjusted discount rate or required rate of return from stock holding.

Shareholders' right

- Right to claim on dividend pay-out by firms/corporation.
 - Cash dividend:
 - $CF_t = D_t$
 - D_t : the cash dividend payment in period t

Gordon model or Dividend cash flow (DCF) model

- Case 1: Constant dividend

$$- E(CF_t) = D \quad \forall t$$

$$- V_0 = D \left\{ \frac{1}{1+r} + \frac{1}{(1+r)^2} + \dots + \frac{1}{(1+r)^T} + \dots \right\} = \frac{D}{r}$$

Gordon model or Dividend cash flow (DCF) model

- Case 2: Dividend grow at rate “g” per period.
 - Suppose that $CF_0 = D_0$
 - $E(CF_1) = (1 + g)D_0$; $E(CF_2) = (1 + g)^2 D_0$;
 $E(CF_3) = (1 + g)^3 D_0$
 - $V_0 = D_0 \left\{ \frac{1+g}{1+r} + \frac{(1+g)^2}{(1+r)^2} + \dots + \frac{(1+g)^T}{(1+r)^T} + \dots \right\} = \frac{D_0(1+g)}{r-g}$
 - $V_0 = \frac{D_1}{r-g}$, $r > g$

The Gordon Growth Model

Assumptions:

- Dividends are the correct metric to use for valuation purposes.
- The dividend growth rate is forever: It is perpetual and never changes.
- The required rate of return is also constant over time.
- The dividend growth rate is strictly less than the required rate of return.

Example: Suppose that a company pays out dividend at \$5 in the initial date. The pay out is expected to grow at the rate of 4% per year. Suppose that the required market rate of return for this stock is 8%. Calculate the fair price of the stock?

$$V_0 = \frac{D_1}{r - g} = \frac{5 * (1 + 0.04)}{0.08 - 0.04} = \$ 130 \quad (r > g)$$

When Is the Gordon Growth Model **Most** Appropriate for Valuing Equity?

Dividend-
paying
company



Insensitive to
the business
cycle



Use the
Gordon
growth model



Mature
growth phase

Practical issues 1:

Estimating a Long-Term Growth Rate



$b = 1 - \text{dividend pay-out ratio}$

ROE = net earning to equity



Practical issues 2: 100% Earning retention



$b = 1$
No dividend
policy



Valuation???

Dividend growth → price changes

AMZN	Amazon.com Inc.	\$142,290.00	31.20%	0.3	-0.30%
GOOGL	Google Inc.	\$352,810.00	22.40%	0.05	20.20%
NFLX	Netflix, Inc.	\$20,150.00	26.20%	0.52	4.50%

- These are some examples of companies that do not pay out their dividend.
- Underlying reasons?

Shareholders' right

- Right to claim on dividend pay-out by firms/corporation.
 - Cash dividend:
 - $CF_t = D_t$
 - D_t : the cash dividend payment in period t
 - Stock dividend:
 - Instead of paying out dividend in cash, offer investors new shares.
 - This is all about dividend policy.
 - Good for firm: **Cash hoarding for firms investment.**
 - Good for investors: **wait to earn higher return in the future/tax shield.**

Present Value Models

Value of an investment = present value of expected *future benefits*

Future benefits =
dividends

$$V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t}$$

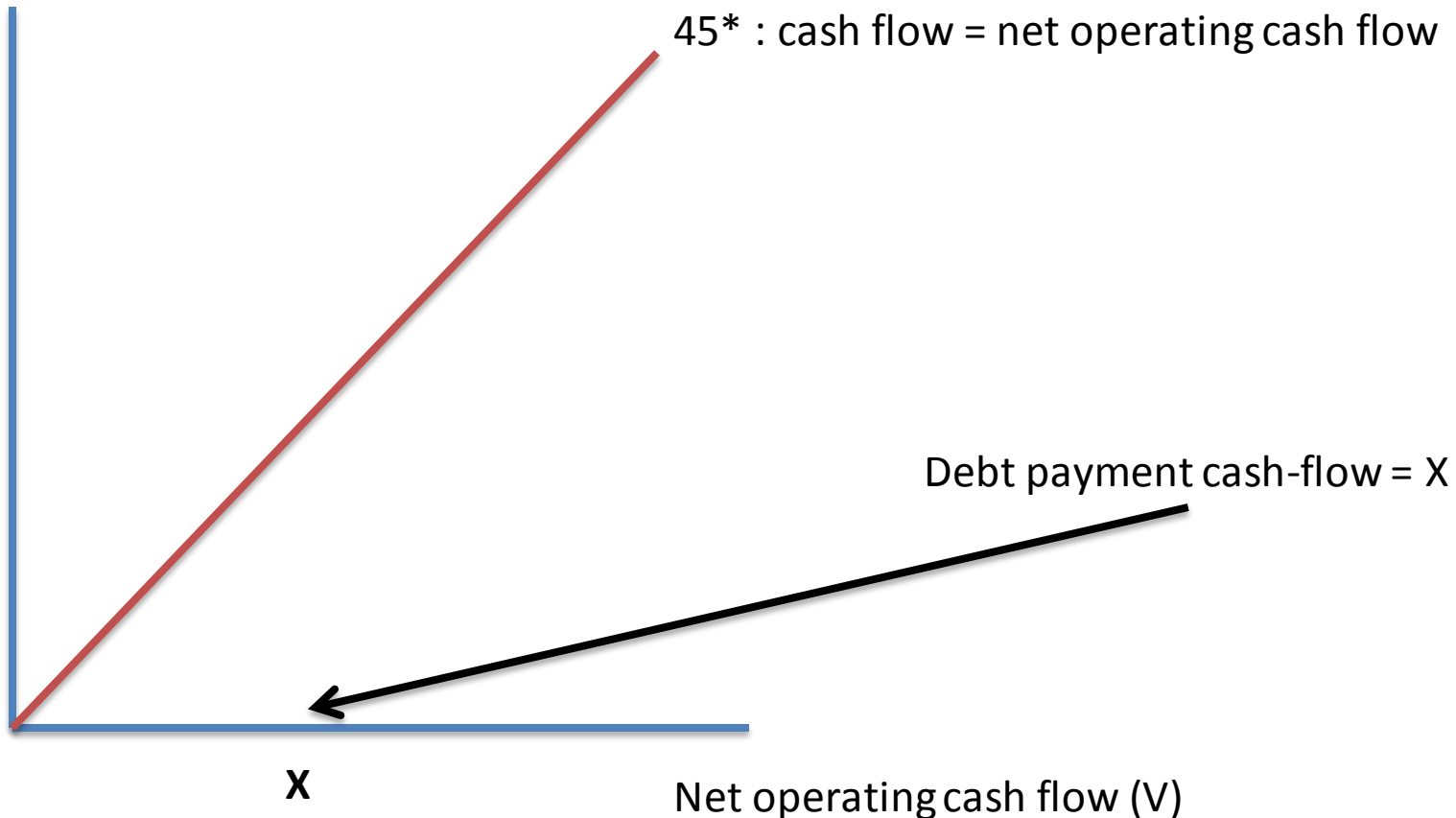
Future benefits = free
cash flow to equity

$$V_0 = \sum_{t=1}^{\infty} \frac{FCFE_t}{(1+r)^t}$$

Firm value: Stock vs debt

Alternative form of fund-raising: stock vs debt

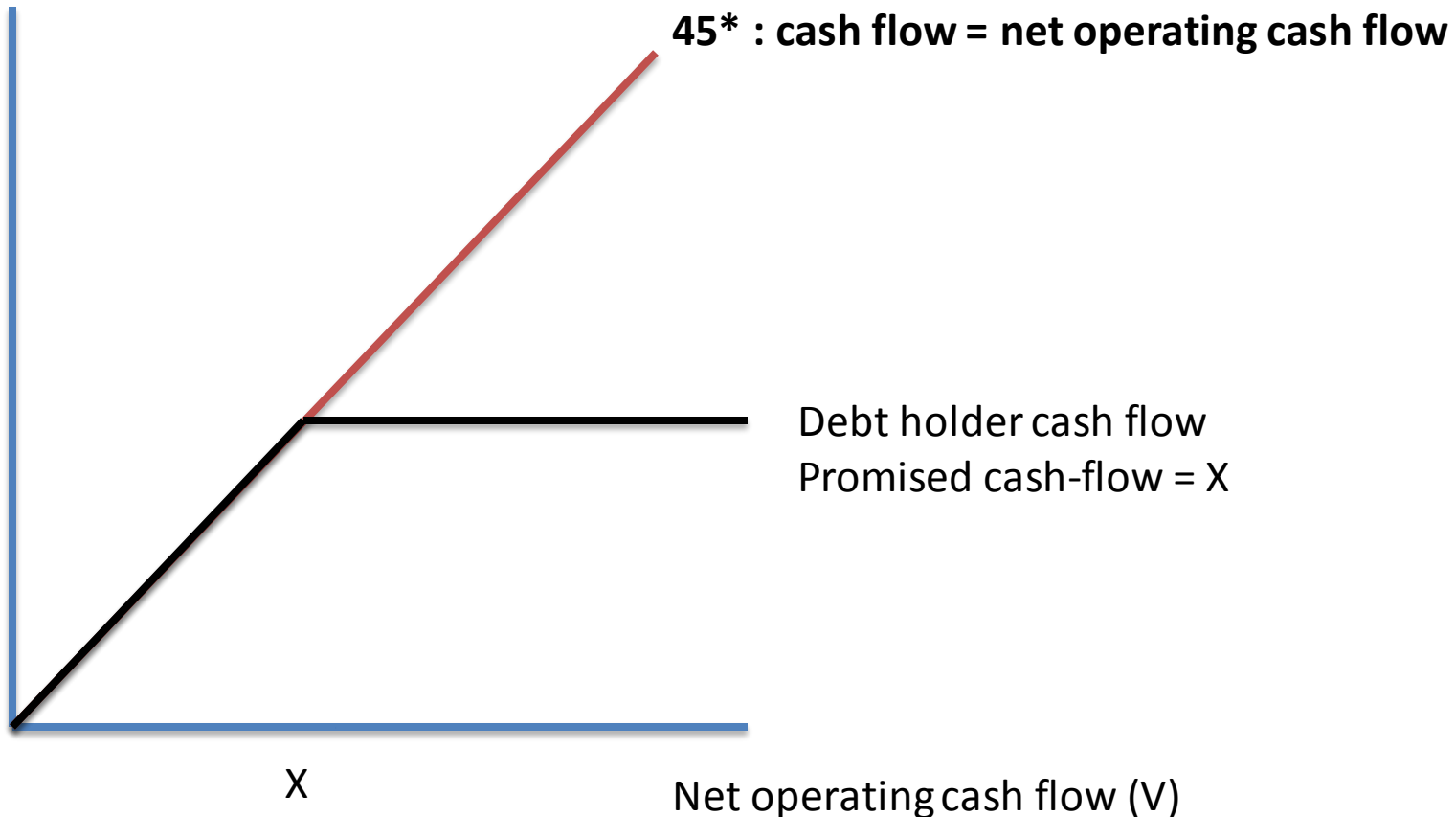
Cash flow (value to firms)



Firm value: Stock vs debt

Alternative form of fund-raising: stock vs debt

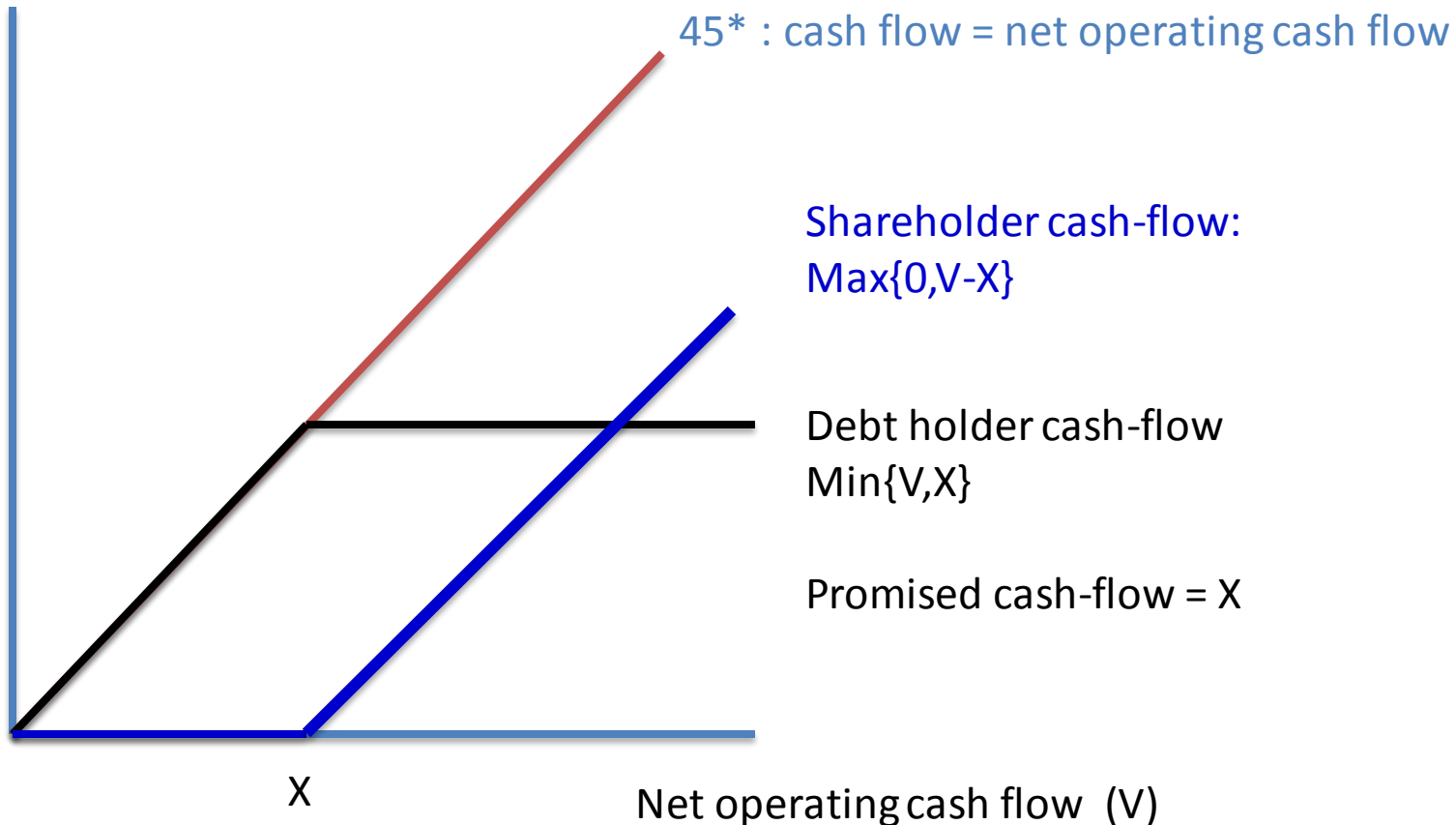
Cash flow



Firm value: Stock vs debt

Alternative form of fund-raising: stock vs debt

Cash flow



Dividend growth → price changes

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Claim on FREE cash flow to Equity holder (free from debt obligations and could be claimed by equity holders.)

**(Revenue – Cost – Net depreciation)(1-tax)
+ net depreciation – capital expenditure – interest
expense*(1-tax) = Free cash flow claimed by equity holder**

Summing up

- Knowing basic techniques for stock valuation
- Basically, stock price is determined by firm's potential growth.
- Most of the time, this is reflected in terms of dividend. Potential growth firm should pay out high dividend.
- In practice, some companies do not pay-out dividend.
- Valuation of these companies require measuring a proxy for cash-flow that is owned by equity holder.
- The commonly used concept is the “free cash flow”. Free cash flow basically measures net earning of a firm, after deducting all the expenses incurred in the operation of firm. It reflects the residual parts that can be claimed by shareholders.

What's left behind, and not discussed so far is

- “*Required rate of return*” used for discounting cash-flow of stock!

Agendas

- Stock valuation techniques
- The equilibrium required rate of return: CAPM
- Behavior of stock prices (in another separate lecture slide)

Subjective v.s. equilibrium required rate of return

- Subjective required rate of return.
 - Subjective valuation of stock for each individual
- Suppose that we want make a good estimate for the current equilibrium price, what do we need to know?
 - Equilibrium required rate of return of the stock.
- Any theory that we can consult for?
 - CAPM theory

CAPM Theory

- Equilibrium predictions for the rate of return of risky asset.
 - Developed by William Sharpe, who built upon the framework of Harry Markowitz.
- Risk-free rate v.s. return of Risky asset → linked together with a linear equation, called the CAPM equation.

CAPM theory: the equation

- William Sharpe proved that the equilibrium required rate of return of asset “j” is given by the following linear equation.

$$r_j = r_f + \beta_j(r_m - r_f)$$

Required premium

r_m = return of the overall market portfolio
(stock market index)

r_f = risk-free rate (e.g. 3-month T-bills)

CAPM theory: the equation

- What does the equation tell us?

$$r_j = r_f + \beta_j(r_m - r_f)$$

- Investors require premium to compensate for the risk of asset.
- Required premium of an asset is tied to the market excess return $(r_m - r_f)$, i.e. overall market premium, and with β_j , i.e. an asset-specific coefficient.

CAPM theory: the equation

- What is β_j ?

$$\beta_j = \frac{\text{cov}(r_j, r_m)}{\sigma_m^2}$$

- How much required premium would be needed depends on the size of β_j .

CAPM theory:

what drives required premium

- To show this, rewrite the equation in terms of correlation and risk of asset

$$r_j = r_f + \frac{\text{cov}(r_j, r_m)}{\sigma_m^2} (r_m - r_f)$$

$$r_j = r_f + \frac{\text{cov}(r_j, r_m)}{\sigma_m \sigma_j} \sigma_j \frac{(r_m - r_f)}{\sigma_m}$$



$$r_j = r_f + \text{cor}(r_j, r_m) \frac{(r_m - r_f)}{\sigma_m} \sigma_j$$

CAPM theory: *risk to be priced in?*

- Risk of asset = σ_j (standard deviation on the return of asset j)

$$\text{Required premium} = \text{cor}(r_j, r_m) \frac{(r_m - r_f)}{\sigma_m} \sigma_j$$

- From the equation, Sharpe interpreted that “part of **the variation in return of risky asset** that will be **priced** must be the part that is correlated across system-wide”

CAPM theory: *risk to be priced in?*

- Consider two assets: 1 and 2 in which $\sigma_1 < \sigma_2$ and $\text{cor}(r_1, r_m) > 0$ but $\text{cor}(r_2, r_m) = 0$

$$\text{Required premium} = \text{cor}(r_j, r_m) \frac{(r_m - r_f)}{\sigma_m} \sigma_j$$

- From the CAPM 1, perceived risk of asset 2 will not be priced in at all because return on asset 2 has not systematic relationship with market-wide return (r_m)

CAPM THEORY: Intuition

- Consider the following return process of an asset issued by firm “j”.

$$r_{j,t} = \mu_j + \theta_{j,t} + s_t$$

μ_j = mean return of asset j.

$\theta_{j,t} \sim N(0, \sigma^2)$ = firm-level risk (shocks)

$s_t \sim N(0, \sigma_s^2)$ = aggregate-level risk (shocks)

CAPM THEORY: two risk components

- As we had seen, to attract investors to choose the risky asset, an excess return (over risk-free rate) must be required. (Obvious!)
- What is not obvious, and asked by William Sharpe is the following two questions:
 - What types/parts of risk associated with the investment on risky asset (e. g. $\theta_{j,t}, s_t$) should investor call/ask for the premium to compensate for the risk?
 - And, to which extent, should the investor require the premium to compensate such a particular type of risk?

CAPM THEORY: law of large number!

- Intuitively, part of the return driven by **idiosyncratic risk** (*firm-level shocks*) does not need any premium!
- Following *Markowitz*, risk-averse investor can eliminate the idiosyncratic risk by using the portfolio diversification.
 - This follows from the **Law of the large number**; firm-level shocks should be completely washed out!

CAPM theory: aggregate-level risk

- What should remain is the aggregate-level shocks, i.e. the shocks that cause the system-wide movement in the rate of return across all the assets.
- Thus, investor would only require premium to compensate the aggregate risk!
- This is proxied by $\text{cor}(r_j, r_m) \frac{(r_m - r_f)}{\sigma_m}$

Stock return for some selective industries:

Common sample descriptive statistics

	Energy	Health	Food
Mean	11.93686	9.844387	8.359293
Std. Dev.	34.94901	39.57253	24.05465
Observations	295	295	295

Given the risk, shouldn't return on health sector be highest? No, market doesn't think so!!

Covariance Analysis: Ordinary				
Date: 08/22/17 Time: 08:01				
Sample: 1992M01 2016M07				
Included observations: 295				
Balanced sample (listwise missing value deletion)				
Correlation				
Probability	energy	Health	food	market
	1			
market	0.690556	0.682075	0.642622	1
	0	0	0	-----

CAPM theory: practical use 1.1

- Practical use of the CAPM is to estimate “*beta*” using the regression.
- Then, use the expected value of the rate of return on risky asset as the proxy for the required rate of return for discounting cash-flow of the risky asset.
- This is common approach for *unlevered* firms!

CAPM theory: practical use 1.2

- Most companies have sophisticated structure of financing.
 - Mixture of debt and equity
- Required rate of return implied by the CAPM is not appropriate.
- Weighted Average Cost of Capital (**WACC**) is more appropriate concept.

$$\mathbf{WACC} = r_D (1 - T_c) * (D / V) + \mathbf{r_E} * (E / V)$$

CAPM theory: practical use 2

- Stock selection!
- Suppose the one believes in CAPM equation, required rate of return should be equal to
$$r_j^{CAPM} = r_f + \hat{\beta}_j(r_m - r_f)$$
- Let $r_{j,t}$ be the actual return at time “t” of asset j.
- If $r_{j,t}$ is lower (higher) than r_j^{CAPM} , security is overpriced (underprice). Hence, price is to be falling (rising) soon.
 - Recommendation: sell (buy) strategy is advised.