Financial Markets
1: Stocks

Stefano Lovo

HEC, Paris

Objective of this course

1. Get familiar with the most common financial assets.
2. Recognize the payments that these assets make to their holders.
3. Determine the price at which these asset are traded in the financial market.
4. Once what these standard assets are understood, see how we can relate them to sustaniability

What financial assets we study in this course?

- Stocks (Part 1)
- Bonds (Part 2)
- Derivatives
  - Forwards and futures (Part 3)
  - Options (Part 4)

Financial markets' sizes

- Values in trillion US $

	GDP	Stocks	Bonds	Derivatives
World	81	69	90	530*
USA	19.4	26.0	39.3	
Euro area	12.6	6.5	17.0	
China	12.2	7.9	11.8	
Japan	4.8	4.9	12.7	
Germany	3.7	1.7	3.7	
France	2.6	2.2	4.6	
UK	2.6	3.2	6.0	

* notional value

Pre-requisite for this Course

- Time value of money:
  - Interest rate
  - Discount rate
  - Future value
  - Present value
  - Annuities
- CAPM
  - Market portfolio and its return.
  - Beta of an asset.
  - Security Market Line: $E[\tilde{r}_i] = r_f + \beta_i(E[\tilde{r}_M] - r_f)$

Housekeeping 1/4

Material

–Slides + Reader

–Problem sets + Practice quizzes + Practice exam

–Textbook (Optional) *Investments*, by Bodie, Kane and Marcus

–Tutorials (Optional), dates on the syllabus.

–Office hours

– All class material can be found on **www.hec.fr/lovo**

Housekeeping 2/4

Evaluation

(1) Best 3 out of 4 quizzes = 1/3 of final grade (100/300)

– 10 min at beginning of class, closed-book on Blackboard
– Bring a calculator
–No possibility to do the quiz on paper (Check your OS is up to date so that Respondus does not bug)
– No make-up quizzes
– You must be in the classroom to take the quiz
– If you take the quiz, you also take the rest of the class.
–Justified absence to quiz: certified seekness or death of close relative

(2) Final exam = 2/3 of final grade (200/300)

– 1.5 or 2 hours, on paper, (1 cheat sheet allowed)

Housekeeping 3/4

Graded on a curve an all my groups:

- A: between top 10% and top 20%
- A+B: between top 20% and top 40%
- A+B+C: between top 40% and top 70%
- A+B+C+D+E: between top 70% and 100%
- FX+F: Max 30%

Housekeeping 4/4:

- **COVID 19 manners:**

  If you have any symptoms of flu or cold, please wear a mask on mouth and nose, even if you tested negative from COVID 19.

- If you attend class, BE in class:
  - Be in the classroom at the time the class starts
  - Put your cellphone away and in silent mode
  - Ask questions whenever you feel are relevant
  - Use your computer only for class relevant matters

Part 1: Stocks & Market Efficiency

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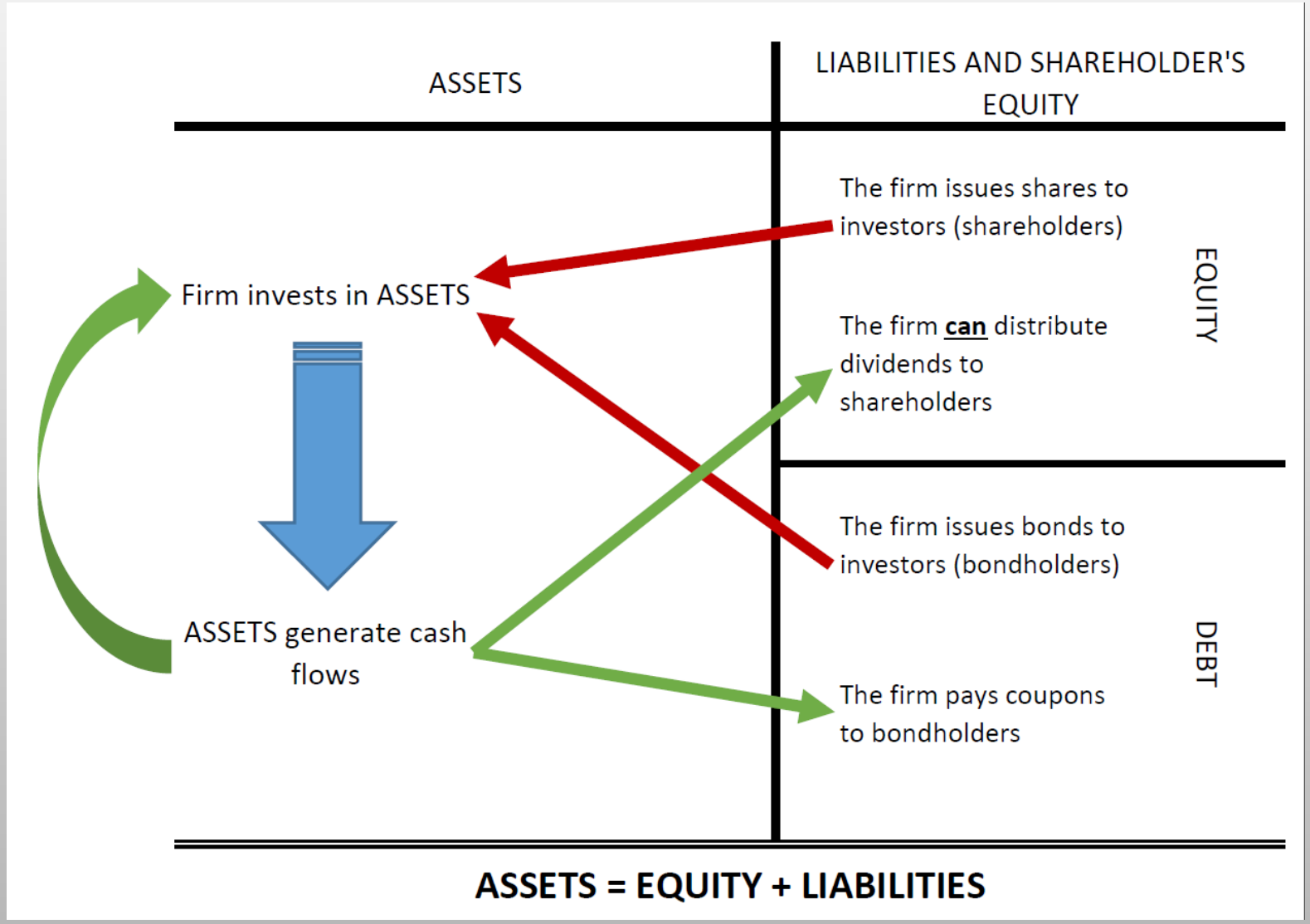
Overview

1. Stock basics
2. Dividend Discount Model
3. Present Value of Growth Opportunities
4. Price-Earnings ratio
5. Market efficiency
6. (Law of one price)

Balance sheet of a firm



Stock definition

Definition

A share of common stock (also referred to as stock or equity) is a financial contract that represents ownership of a specific portion of the company that has issued it.

Stockholders' rights

(stockholder = shareholder = equity holder)

1. Ownership rights
   - The firm belongs to stockholders (unless it is bankrupt)
   - Stockholders approve the firm's important decisions
   - Stockholders hire and fire managers of the management board.
2. Residual cash-flow rights
   - The firm pays suppliers, employees, tax authorities first

     . . . then creditors (banks, bondholders)

     . . . whatever is left **can** be distributed as dividends to stockholders
   - Stockholders have limited liability

Stock Cash-flows

Time	year 1	year 2	...	year n	...
Cash flow	$\tilde{D}_1$	$\tilde{D}_2$	...	$\tilde{D}_n$	...

where $\tilde{D}_t$ is the dividend that each shareholder will receive at time t.

Important Remark: Today, future dividends are not known. For this reason we treat them as random variables.

Market capitalization vs. book value

- Example: Apple

  book value = \$63 billion

  market cap = \$2 300 billions

- Book value = equity capital booked on the balance sheet $\rightarrow$ determined by accounting rules
- Market capitalization = number of shares $\times$ price of one share $\rightarrow$ what determines how much stock market investors are willing to pay for a stock?

Valuing a stock

Example A stock is selling today for $P_0 = €30$. The analysts expect that the company will pay a dividend of $D_1 = €2$ in exactly one year. You expect to sell the stock right after the dividend payment in one year at a price of $P_1 = €33$.

- What is your expected holding period return?

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- What is your expected holding period return?

$$HPR = \frac{\text{expected profit}}{\text{initial investment}} \quad \underbrace{\frac{E[D_1]}{P_0}}_{\text{dividend yield}} + \underbrace{\frac{E[P_1] - P_0}{P_0}}_{\text{cap. gain (or loss)}} =$$

$$0.0667 + 0.1 = 16.667\%$$

- **Remark:** Neither capital gain (or loss) nor dividend yield is guaranteed!
  Your realized return may be different from your expected return

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- Should you buy this stock?

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- What is your expected holding period return?

  16.667%

- Should you buy this stock?
  Cannot answer, depends on the riskiness of the stock: need to compare this expected HPR to the required rate of return.

Stock valuation problem

Short term investor: an investor who plans to buy a stock, hold it for 1 year, cash-in the dividend (if any) and sell the stock.

Time:	today	year 1
Action:	buy the stock	cash-dividend and resell
Cash-flow:	$-P_0$	$\tilde{D}_1 + \tilde{P}_1$

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$$\text{Expected Net present Value} = E[NPV] = -P_0 + \frac{E\left[\tilde{D}_1 + \tilde{P}_1\right]}{1+k}$$

where k is **the opportunity cost of capital**, i.e., the interest rate the investor could gain in an alternative investment with the same risk factor.

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where k is **the opportunity cost of capital**, i.e., the interest rate the investor could gain in an alternative investment with the same risk factor. According to the CAPM...

$$k = r_f + \beta_i(E[\tilde{r}_M] - r_f)$$

Valuing a stock; CAPM Refresher:

In the Capital Asset Pricing Model (CAPM), the expected return is given by

$$k = r_f + \beta(E[r_M] - r_f)$$

r_f: risk-free rate

β: systematic risk = part of the risk that cannot be eliminated by holding a diversified portfolio

$E[r_M] - r_f$: equity risk premium = expected excess return on the market portfolio (remember "excess return" means return minus risk-free rate)

A simple problem

Consider a 1 year investment in stock ABC with $\beta = 1.1$. You have the following information:

$$\begin{aligned} P_0 &= €30, E[\tilde{D}_1] = €2, E[\tilde{P}_1] = €33 \\ r_f &= 2\%, E[\tilde{r}_M] = 25\% \end{aligned}$$

Suppose CAPM holds. Would you buy or short sell the asset?

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$$E[NPV_{buy}] = -P_0 + E\left[\frac{\tilde{D}_1 + \tilde{P}_1}{1+k}\right] = -30 + \frac{2+33}{1+27.3\%} = -2.51$$

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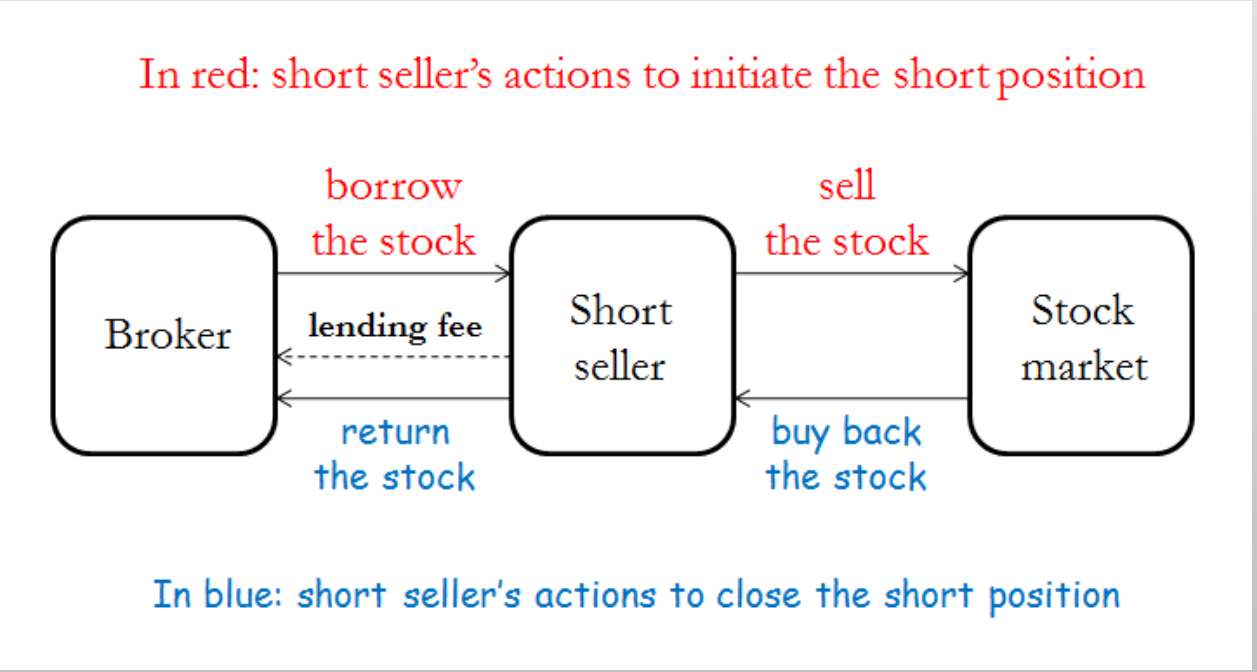
Short selling

- A short sale is the sale of a security you don't own



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$$P_0 = V_0 := E\left[\frac{\tilde{D}_1 + \tilde{P}_1}{1+k}\right] = \frac{2+33}{1+27.3\%} = 27.49$$

- I f there is equilibrium between demand and supply for a given stock, how the stock opportunity cost of capital compares to the stock expected holding period return?

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  $OCC = HPR$

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$$V_0 = \frac{33 + 2}{1.273} \simeq €27.49$$

Some Limitations of CAPM Model

- CAPM relies on several key assumptions:
  - Frictionless markets and “perfect" information
  - Investors are rational and care about financial payoffs only
  - Can you think of more?
- Moreover: Accurate measurement of CAPM quantities (e.g., β) is not easy in practice
- While easy and intuitive, CAPM assumptions might not always hold

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- While easy and intuitive, CAPM assumptions might not always hold
- Example: Suppose that investors not only care about financial payoffs but also about ESG criteria
  - ESG =Environmental, Social, and Governance

Example: CAPM and ESG

- Consider a 1 year investment in two stocks S (“Solar Energy") and O (“Oil Producer"), each with (hypothetical) $\beta = 1$, an expected dividend in year 1 of $E[\tilde{D}_1] = €2.5$, and an expected price $E[\tilde{P}_1] = €10$.

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- According to CAPM, the opportunity cost of capital is: $\boxed{k = r_f + \beta(E[r_m] - r_f) = 25\%}$.
- And, the stock price for both stocks is identical at

$$\boxed{P_0 = \frac{E[\tilde{D}_1] + E[\tilde{P}_1]}{1 + k} = \frac{12.5€}{1.25} = 10€}$$

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- Now, suppose the actual price of S is higher than the price of O, i.e., $P_0(S) = 11€ > P_0(O) = 9€$
- How to make sense of it?

Example: CAPM and ESG (Ctd.)

- Price difference could be due to investors' ESG preferences:
  - Investors value *S* above fundamental value, because it's "green"
  - Investors value *O* below fundamental value because it's "dirty"

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- The CAPM with this additional (emotional) dividend would imply

$$P_0(S) = 11€ = \frac{E[\tilde{D}_1 + D^{emo,S}] + E[\tilde{P}_1]}{1+k} = \frac{12.5€ + E[D^{emo,S}]}{1.25}$$

- We calculate: $\boxed{E[D^{emo,S}] = 1.25€}$. How to calculate $E[D^{emo,O}]$?

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- Show that $\boxed{E[D^{emo,O}] = -1.25€}$

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- The introduction of “emotional" dividend is a way to account for investors’ ESG preferences but cannot be measured
  - Alternatively: One could account for ESG preferences via the discount rate k. Left as optional exercise.

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- Calculate the dividend yield: $\frac{E[\tilde{D}_1]}{P_0(S)} = \frac{2.5€}{11€} \approx 23\% < \frac{E[\tilde{D}_1]}{P_0(O)} = \frac{2.5€}{9€} \approx 28\%$
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- Calculate the expected holding period return, $\frac{E[\tilde{D}_1+\tilde{P}_1]}{P_0(S)}$ and $\frac{E[\tilde{D}_1+\tilde{P}_1]}{P_0(O)}$ for both stocks? Which stock has higher EHPR?

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- Calculate the expected holding period return, $\frac{E[\tilde{D}_1+\tilde{P}_1]}{P_0(S)}$ and $\frac{E[\tilde{D}_1+\tilde{P}_1]}{P_0(O)}$ for both stocks? Which stock has higher EHPR?
- Key takeaway: Investor ESG preferences challenge key assumptions of CAPM model. However, CAPM model can be modified to accommodate investor ESG preferences. However, how to do so in the best way is still subject to debate.

Dividend Discount Model (DDM)

Consider an investor that plans to take a position (long or short) into a stock for n years. Let k be the annual required return given the risk of this stock (opportunity cost of capital).

Excess demand for the stock

$$P_0 < \frac{E[\tilde{D}_1]}{(1+k)^1} + \frac{E[\tilde{D}_2]}{(1+k)^2} + \cdots + \frac{E[\tilde{D}_n + \tilde{P}_n]}{(1+k)^n}$$

Excess supply for the stock

$$P_0 > \frac{E[\tilde{D}_1]}{(1+k)^1} + \frac{E[\tilde{D}_2]}{(1+k)^2} + \cdots + \frac{E[\tilde{D}_n + \tilde{P}_n]}{(1+k)^n}$$

Equilibrium price only if

$$P_0 = \frac{E[\tilde{D}_1]}{(1+k)^1} + \frac{E[\tilde{D}_2]}{(1+k)^2} + \cdots + \frac{E[\tilde{D}_n + \tilde{P}_n]}{(1+k)^n}$$

Poll 1: investing horizon

Consider the following three investors willing ton buy stock ABC

1. Investor 1 plans to resell the stock after one year
2. Investor 2 plans to resell the stock after two year
3. Investor 3 plans on holding the stock forever

Which investors values the stock the most?

Poll 1: investing horizon

Investor 1 plans to resell the stock after one year

Investor 2 plans to resell the stock after two year

Investor 3 plans on holding the stock forever

Fundamental value of a stock

Definition

The fundamental value of a stock V_0 is the present value of the expected infinite stream of future dividends that the stock will pay, using the opportunity cost of capital given the risk of the stock:

$$V_0 = \frac{E[\tilde{D}_1]}{(1+k)^1} + \frac{E[\tilde{D}_2]}{(1+k)^2} + \cdots + \frac{E[\tilde{D}_n]}{(1+k)^n} + \cdots = \sum_{t=1}^{\infty} \frac{E[\tilde{D}_t]}{(1+k)^t}$$

Fundamental value of a stock

Theorem

Under the CAPM assumptions, the equilibrium price of a stock is equal to its fundamental value.

- The fundamental value V_0 of a stock does not depend on your holding period (e.g., whether you hold it for 1 year, 2 years, or forever)
- To calculate V_0 you need to specify a scenario for the dividend schedule.

Constant Growth DDM

- Simplest scenario: dividends grow at constant rate g
- The DDM becomes

$$V_0 = \frac{(1+g)D_0}{1+k} + \frac{(1+g)^2 D_0}{(1+k)^2} + \ldots + \frac{(1+g)^T D_0}{(1+k)^T} + \ldots$$

- And if $k > g$, using the perpetuity formula with infinite horizon

$$\boxed{V_0 = \frac{D_1}{k-g} = \frac{(1+g)D_0}{k-g}}$$

  The DDM with constant growth rate is called the Gordon model

- $g \geq k$ cannot happen.Why?

Example

Hi5 Inc. has just paid an annual dividend of €2.5 per share. You expect the dividend to grow at 5% per year indefinitely. Given its riskiness, you require an expected return of 12% per year on this stock.

- What is the value of Hi5's stock?

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$$D_0 = €2.5 \quad g = 0.05 \quad k = 0.12 \quad \Rightarrow V_0 = \frac{(1+g)D_0}{k-g} = \frac{1.05 \times 2.5}{0.12 - 0.05} = 37.50€$$

- The company is financed with 1 million shares outstanding. What is the market capitalization of Hi5?

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$$37.5 \times 1 \text{ million} = 37.5 \text{ million } €$$

- An investor is offering to sell Hi5 shares at €35 per share.What do you think?

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$$D_0 = €2.5 \quad g = 0.05 \quad k = 0.12 \quad \Rightarrow V_0 = \frac{(1+g)D_0}{k-g} = \frac{1.05 \times 2.5}{0.12 - 0.05} = 37.50€$$

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$$37.5 \times 1 \text{ million} = 37.5 \text{ million } €$$

- An investor is offering to sell Hi5 shares at €35 per share.What do you think?

Poll 2: Companies that paid no dividend

Google and Faceboock never paid any dividend. Nevertheless their shares have a positive price in the stock market

Is this in contradiction with the discounted dividend model?

DDM: life cycle considerations

Many firms do not pay dividends Facebook Google

- What is the value of their equity?

DDM: life cycle considerations

Many firms do not pay dividends Facebook Google

- What is the value of their equity?
  Assumption of constant growth rate of dividends not appropriate for these stocks. They have positive value because (investors expect that) they **will eventually** pay dividends. Need to consider different scenarios of dividend schedules for these stocks $\rightarrow$ multi-stage growth DDM.

[See problem 2 in problem set on stocks.]

Present Value of Growth Opportunities

- Growth opportunities arise if the company retains some of its earnings and invests them in new projects
- The retention ratio or plowback ratio (b) is the proportion of earnings per share (EPS, or E_t) that is reinvested in new projects
- The dividend payout ratio ($1 - b$) is the proportion of earnings per share paid out as dividend
- If new projects have returns on investment (or returns on equity) of $\text{ROE}^{\text{new project}}$, then the growth rate of the company's earnings is

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- What is P_0?

$$P_0 = \frac{E_1 (1 - b)}{k - b \times ROE}$$

Poll 3: Example

FatCat Co. has earnings per share $E_1 = €4$ and a required rate of return of 10% per year

Q1 If FatCat pays out all earnings as dividends forever, what is its fundamental value?

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Now, suppose FatCat increases its retention ratio to 25% to undertake new projects that generate returns on investment of 16% per year

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Q4 What is FatCat stock's new fundamental value (assuming next year's earnings are still 4€ per share)? Ans. €50

Recap about stock pricing formula so far...

- In general:

$$V_0 = \frac{E[\tilde{D}_1]}{(1+k)^1} + \frac{E[\tilde{D}_2]}{(1+k)^2} + \cdots + \frac{E[\tilde{D}_n]}{(1+k)^n} + \cdots = \sum_{t=1}^{\infty} \frac{E[\tilde{D}_t]}{(1+k)^t}$$

- If dividends grow at a constant rate $g < k$, then

$$V_0 = \frac{D_1}{k-g}$$

- If the growth of dividends is obtained by consistently reinvesting at interest rate ROE a fraction b of earnings, then

$$V_0 = \frac{E_1(1-b)}{k - bROE}$$

where: k=OCC; g= dividend rate of growth; b= plowback ratio; ROE= return on equities.

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- what is ThinDog stock price if 60% of earning are reinvested into the firm at $ROE = 5\%$?

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- what is ThinDog stock price if 100% of earning are consistently distributed to shareholders (i.e., $b = 0$) Ans. €40
- what is ThinDog stock price if 60% of earning are reinvested into the firm at $ROE = 5\%$? Ans. €22.86

Present Value of Growth Opportunities

- We can decompose the firm's stock price P_0 into two components

$$\boxed{P_0 = P_0^{\text{no growth}} + \text{PVGO}}$$

- $P_0^{\text{no growth}}$ is the price that would prevail if the company paid out all its earnings and would not grow ($b = g = 0$)

$$P_0^{\text{no growth}} = \frac{E_1}{k}$$

- PVGO is the Present Value of Growth Opportunities: it is the difference between the actual value of the stock and its hypothetical value if the firm did not grow

$$PVG0 = \frac{E_1(1-b)}{k - b \times ROE} - \frac{E_1}{k}$$

Example

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Q2 What is FatCat's new dividend payout ratio? Ans. 75%

Q3 What is FatCat's growth rate? Ans. 4%

Q4 What is FatCat stock's new fundamental value and PVGO (assuming next year's earnings are still 4€ per share)? Ans. €50 and €10

Growth opportunities and capital budgeting

- When is it the case that $PVGO > 0$?

Growth opportunities and capital budgeting

- When is it the case that $PVGO > 0$?
- How do you relate this to capital budgeting decisions?

Price-Earnings ratio

- The price-earnings ratio P/E is a commonly used financial indicator
- It gives some information on growth rates expected by the market

$$\boxed{\frac{P_0}{E_1} = \frac{1-b}{k-g}}$$

- A higher P/E is indicative of higher PVGO

$$\boxed{\frac{P_0}{E_1} = \frac{1}{k} \times \left[1 + \frac{\text{PVGO}}{P_0^{\text{no growth}}}\right]}$$

- Which company has the highest P/E? Amazon, Apple or Facebook?

Practical use of P/E ratio

1. Another method to value a stock: the “comparables approach“
   - You observe P/E for listed company A and want to value the stock of unlisted company B in the same industry $\Rightarrow$ (P/E of A) $\times$ (Earnings of B)
   - What are the underlying assumptions of the comparables approach?
     Assumption: A and B have same g and k. That’s why we choose A in same industry as B; in practice use several comparable firms A in same industry. See corporate finance course.
2. Time variation in market P/E
   - Historical P/E ratio

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- Fama (1970): A market is informationally efficient if all publicly available information is instantaneously reflected in security prices

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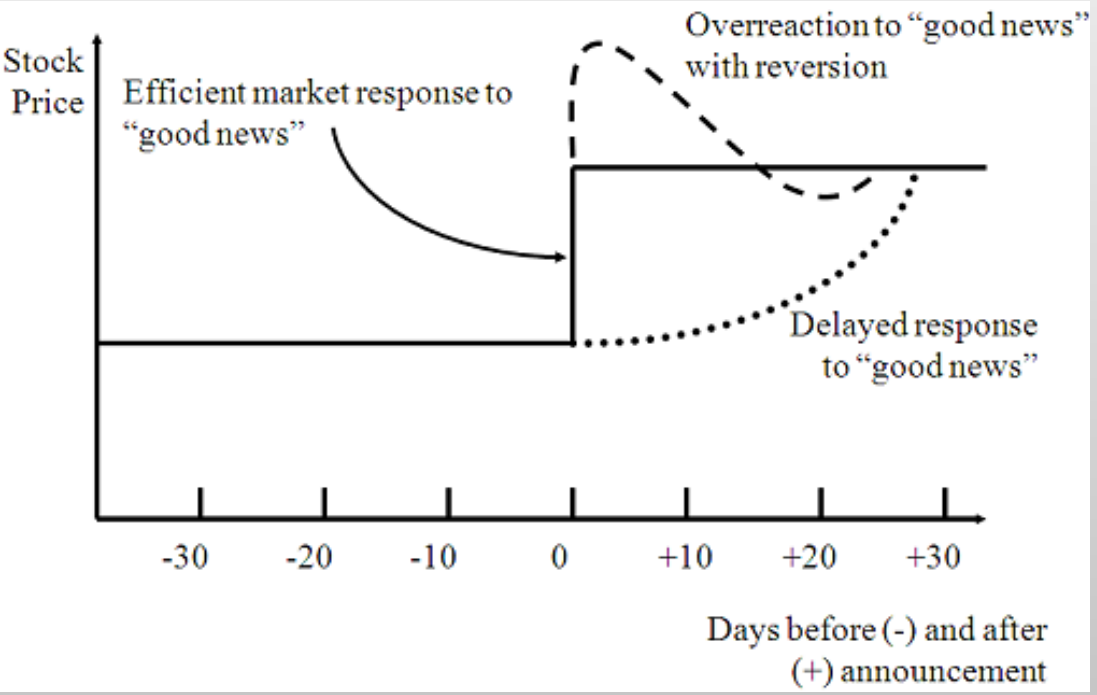
- **Semi-strong-form efficiency:** Trading prices incorporate all public information (past and present).

  You can't beat the market using publicly available information
- **Strong form efficiency:** Trading prices incorporate all information available in the economy (public and private).

  No information of any kind can be used to beat the market.

Informational efficiency

- Example: Stock price reaction to good news



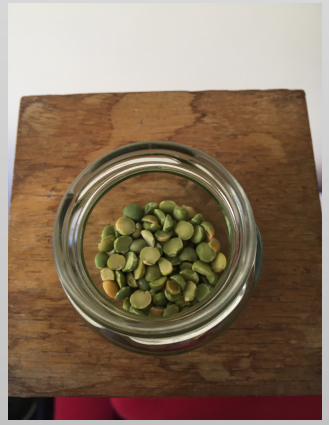
- NB: Informational efficiency is about whether security prices accurately reflect fundamental value, not whether capital markets optimally allocate resources

Why may financial markets be informationally efficient?

1. “Wisdom of the crowd”

   - The market aggregates information disseminated among many investors (even if each single investor has very little info about the fundamental value)

How many dry half green peas are there in this jar?



To answer, please send an e-mail to lovo@hec.fr with subject "beans"

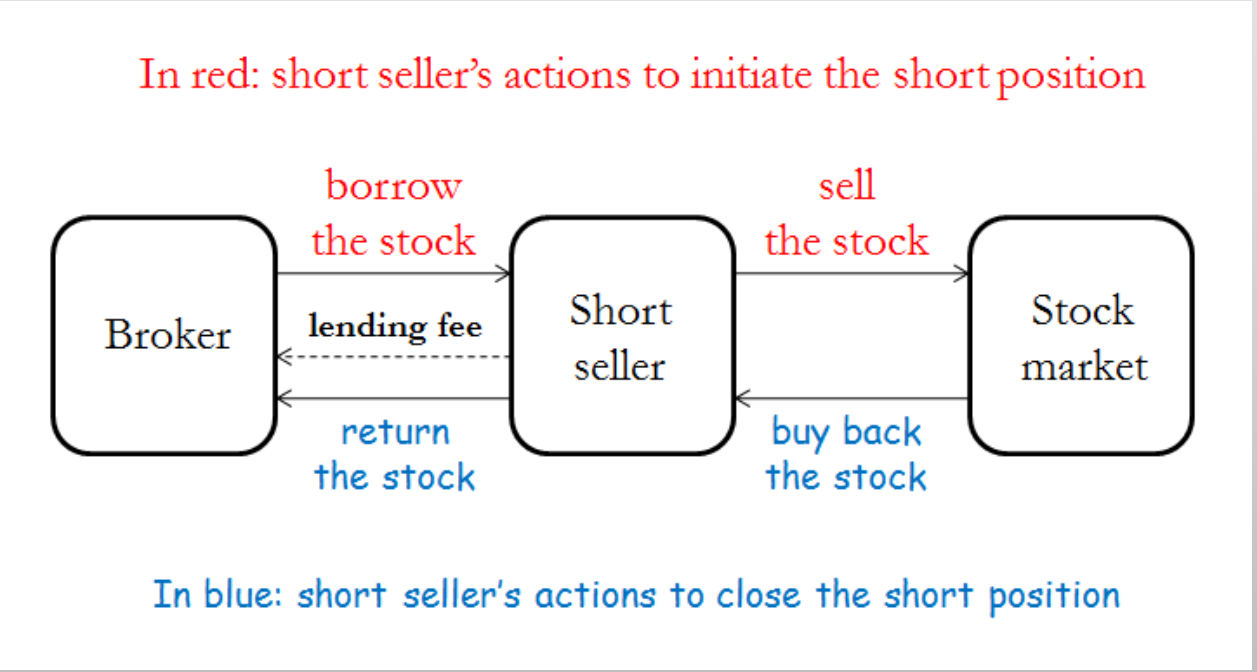
Why may financial markets be informationally efficient?

2. Sophisticated investors

- If price is too low, sophisticated investors buy the stock, pushing the price up
- Conversely, if price is too high, sophisticated investors sell the stock, pushing the price down.
  But what if they don't own the stock?

Short selling

- A short sale is the sale of a security you don't own



Stock return (un)predictability

- If the market is informationally efficient, it is impossible to predict future returns based on available information

Poll: Informational efficiency – Examples

Is market efficiency contradicted in the following situations?

Q1 Through the introduction of a complex computer program analyzing past stock price changes, a brokerage firm is able to predict price movements well enough to earn a consistent 3% profit, adjusted for risk, above normal market return.

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Market Informational Efficiency: Empirical evidence

- Financial market is weak form efficient (no use of technical analysis)
- Financial market is semi-strong form efficient
  - ▸ Market reaction to news
- Financial market is not strong form efficient.
- It is hard to beat the market!