WELCOME TO
Introduction to Finance
for
MSc Financial Technology and Innovation

Lecture 8

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Risk and return – important to know

(Measuring) risk = = (Measuring) firm-dependent + market-dependent factors

- **Variance** and **standard deviation** are our main measures
  - For Beta, I will never have the total data set of all observations, so I control for selection bias
  - I know that transaction data "behaves"
- Measuring the risk of a stock or of a portfolio requires the same conceptual underpinning
- **Beta** would tell me, to what extend I am taking a risk with my investment in the context of the market
- **Correlation Coefficient** would help me measuring if the return profiles of my assets share similar characteristics, i.e. if they "move" the same way; thus, helps measuring portfolio risk!
- **Efficient Market Hypothesis** would indicate that price reflects information, so markets would "know" what is a risky investment, and investors would all hold optimal portfolios
- **Efficient Frontier** (i.e. portfolio / Markowitz theory) would indicate the optimal combination of assets in a portfolio, ie the least risk for a given return and the highest return for a given risk.

Last lecture we covered:

- Continued our journey into risk and return characteristics of
  - Stocks
  - Portfolios
  - Markets

- Introduced Nobel-Price-Worth theories on markets
  - Efficient Market Hypothesis
  - Efficient Frontier (portfolio theory)

Your toolset so far: Fundaments

- PV, FV
- Discount factor
- NPV, DCF
- Rate of Return rule
- Interest rates: simple or compounding

$$\mathrm{PV} = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_t}{(1+r)^T}$$

DCF

$$\mathrm{NPV} = C_0 + \sum_{t-1}^{T} \frac{C_t}{(1+r)^t}$$

$$\mathrm{NPV} = \mathrm{PV} - \text{required investment}$$

$$\text{Return} = \frac{\text{profit}}{\text{investment}}$$

Annual Percentage Rate (APR)

$$\mathrm{APR} = \text{rate per period} \times \text{periods per year}$$

Effective Annual Interest Rate (EAR)

$$\mathrm{EAR} = (1 + \text{rate per period})^{\text{periods per year}} - 1$$

$EAR = [1 + \frac{r}{m}]^m - 1$, where

m = period; ***r*** = rate

Your toolset so far: Series of payments

- Annuity

$$\text{PV of annuity}_t: \; C\times\left[\frac{1}{r}-\frac{1}{r\times(1+r)^t}\right]$$

$$\text{FV of annuity} = C\times\left[\frac{(1+r)^t-1}{r}\right]$$

$$\text{PV of annuity}_{due} = C_1\times\left[\frac{1}{r}-\frac{1}{r(1+r)^t}\right]\times(1+r)$$

- Perpetuity

$$\text{PV of perpetuity} = \frac{C_1}{r}$$

$$\text{PV of perpetuity}_{due} = \frac{C_1}{r}\times(1+r)$$

- Both their rates can grow, in fact(!)

$$\text{PV of perpetuity}_{g=grow} = \frac{C_1}{r-g}$$

$$\text{PV of Growing Annuity} = C_1\times\frac{1}{r-g}\times\left[1-\frac{(1+g)^t}{(1+r)^t}\right]$$

Your toolset so far: Bonds

- Price of a bond = PV of a bond $$\mathrm{PV} = \frac{\mathrm{cpn}}{(1+r)^1} + \frac{\mathrm{cpn}}{(1+r)^2} + \ldots + \frac{(\mathrm{cpn} + \mathrm{par})}{(1+r)^t}$$

- Duration of a bond = weighted average(!) life of cashflows $$\mathrm{Duration} = \frac{1 \times \mathrm{PV}(C_1)}{\mathrm{PV}} + \frac{2 \times \mathrm{PV}(C_2)}{\mathrm{PV}} + \frac{3 \times \mathrm{PV}(C_3)}{\mathrm{PV}} + \ldots + \frac{T \times \mathrm{PV}(C_T)}{\mathrm{PV}}$$

- Modified duration (since returns vary over time, so the cashflow) $$\mathrm{Modified\ duration} = \mathrm{volatility}\,(\%) = \frac{\mathrm{duration}}{1 + \mathrm{yield}}$$

Your toolset so far: Equities

- Understanding the return of a common stock

$$\text{Expected return} = r = \frac{\text{DIV}_1 + P_1 - P_0}{P_0} \quad \text{Expected Return} = r = \frac{Div_1}{P_0} + \frac{P_1 - P_0}{P_0}$$

- DDM

$$\text{Price} = P_0 = \frac{\text{DIV}_1 + P_1}{1 + r}$$

generalizing the one-period calculation + defining a horizont

leads to

$$P_0 = \frac{\text{DIV}_1}{(1+r)^1} + \frac{\text{DIV}_2}{(1+r)^2} + \ldots + \frac{\text{DIV}_H + P_H}{(1+r)^H}$$

- No growth

$$Perpetuity = P_0 = \frac{Div_1}{r} \; or \; \frac{EPS_1}{r}$$

- With growth (Gordon Growth Model)

$$PV_0 = \frac{C_1}{r - g}$$

Your toolset so far: Ratios for equity valuation

$$\text{Payout Ratio} = \frac{Dividend}{Earnings\ per\ Share\ (EPS)}$$

$$\text{Plowback Ratio} = \frac{Earnings\ per\ Share\ (EPS) - Dividend}{Earnings\ per\ Share\ (EPS)} = \frac{Amount\ Reinvested}{Earnings\ per\ Share}$$

Plowback Ratio+ Payout Ratio=1

$$\text{Return on Equity} = ROE$$

$$ROE = \frac{\text{EPS}}{\text{Book Equity Per Share}}$$

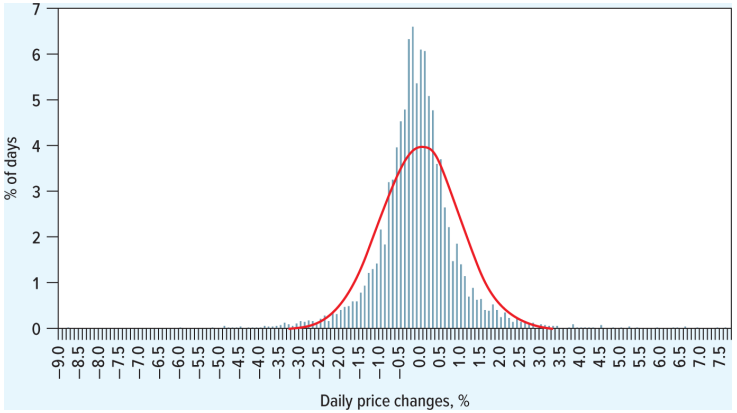
g = return on equity X plowback ratio

Digest the term: Measuring risk

Variance (σ^2)

Average value of squared deviations from mean

For our Finance universe, it means: How "far" are the ***measured*** return results "located" from the average return? It is a measure of volatility: How "volatile" is the average return I calculated?

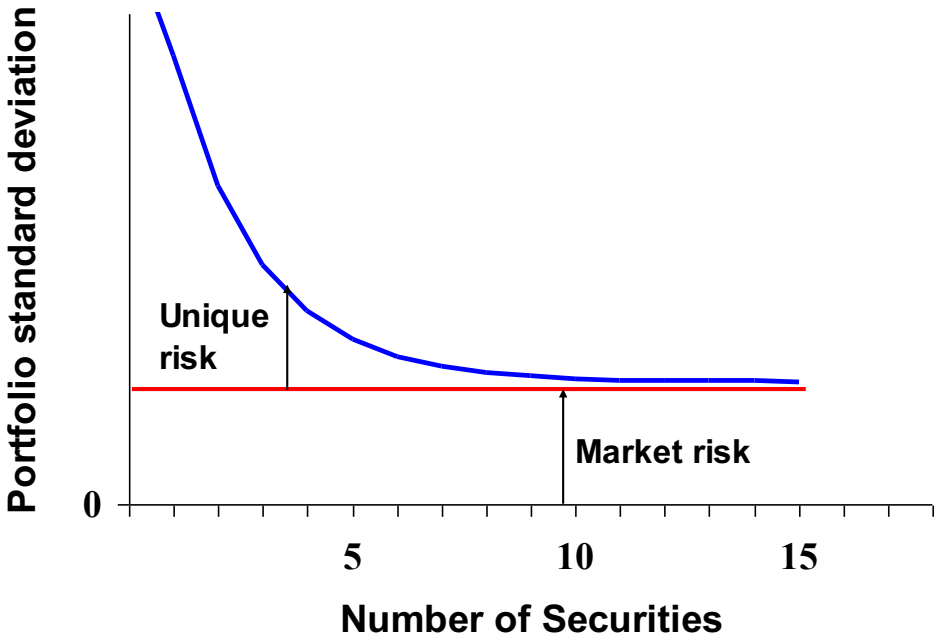


Standard Deviation (σ)

The square-root of Variance.

We "***project***" the return results to a scale and address the "***spread***" of these projected results. Spread corresponds to the **dispersion** of the observed return data relative to its mean. It is as well the measure of volatility.

Diversification reduces variability: reducing exposure to specific (unique) risk associated with assets in portfolio



The more stocks we add to a portfolio, the lower the unique risk associated with the assets included in the portfolio.

Calculating Beta: Following a conceptually similar exercise as for variance and standard deviation

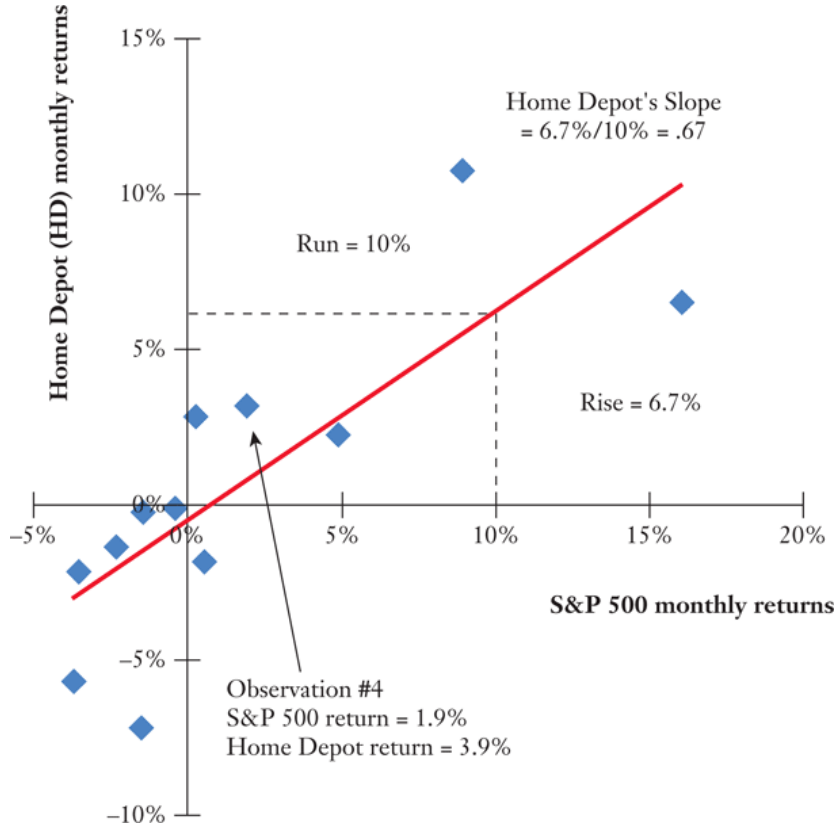
	(B) Market return	(C) Company return	(D) Deviation from average market return	(E) Deviation from average company return	(F) Squared deviation from average market return	(G) Product of deviations from average returns (Columns D x E)
1	**-8**	**-11**	$-8-\mathbf{2}=-10$	$-11-\mathbf{2}=-13$	$(-10)^2=100$	$(-10)\ x(-13)=130$
2	**4**	**8**	$4-\mathbf{2}=2$	$8-\mathbf{2}=6$	$(2)^2=4$	$2\ x\ 6=12$
3	**12**	**19**	$12-\mathbf{2}=10$	$19-\mathbf{2}=17$	$(10)^2=100$	$10\ x\ 17=170$
4	**-6**	**-13**	$-6-\mathbf{2}=-8$	$-13-\mathbf{2}=-15$	$(-8)^2=64$	$(-8)\ x\ (-15)=120$
5	**2**	**3**	$2-\mathbf{2}=0$	$3-\mathbf{2}=1$	$(0)^2=0$	$0\ x\ 1=0$
6	**8**	**6**	$8-2=6$	$6-2=4$	$(6)^2=36$	$6\ x\ 4=24$
Avg.	**2**	**2**		Total	304	456

Variance of market returns $=\boldsymbol{\sigma_m^2}=\frac{304}{5}=60.8$

Covariance between market returns and company returns = $\boldsymbol{\sigma_{im}}\ \frac{456}{5}=91.2$

Beta $\beta=\frac{\text{Variance(company,market)}}{\text{Covariance(market)}}=\frac{\sigma_{im}}{\sigma_m^2}=\frac{91.2}{60.8}=1.5$

In practice, beta is estimated as the **slope** of a straight line: Estimating Home Depot's (HD) Beta Coefficient



Theoretically, beta can take values from minus infinity to plus infinity.

If $\beta_i = 1$ the security's returns will behave exactly as the returns on the market portfolio.

If $\beta_i > 1$ the security's returns are **more volatile** than those on the market portfolio; if the return on the market goes up, the security's return also **rises but in a greater proportion**.

If $\beta_i < 1$ the security's returns are less volatile than those on the market portfolio; if the return on the market goes up, the security's return **rises to a lesser degree.**

Your toolset so far: Measuring risk

Expected portfolio return for two stocks= $(w_1r_1) + (w_2r_2)$

Variance of returns = $\sigma^2 = \sum \frac{(Actual\ Return_n - Expected\ Return)^2}{n-1}$ → Standard deviation → σ

Covariance of returns (for two stocks): $cov_{1,2} = \rho_{12}\sigma_1\sigma_2$ → Correlation coefficient → $\rho_{12} = \frac{\sigma_{12}}{\sigma_1 x\ \sigma_2}$

Portfolio Variance $= x_1^2\sigma_1^2 + x_2^2\sigma_2^2 + 2(x_1x_2\rho_{12}\sigma_1\sigma_2)$

Measure of systemic risk exposure of a stock (Beta): $B_i = \frac{\sigma_{im}}{\sigma_m^2}$

Measuring risk and return seems possible:
Say “HI” to **Efficient Market Hypothesis** (EMH)

The **efficient market hypothesis (EMH)** states that securities prices accurately reflect future expected cash flows and are based on **all information** available to investors.

Eugene F. Fama, Efficient Markets, and the Nobel Prize

Gene's bottom line is always: Look at the facts. Collect the data. Test the theory.

By John H. Cochrane May 20, 2014 CBR - Finance

Principle5 reflects EMH: price reflect information Providing broad support for market efficiency

The complexity of price discovery in an efficient market: the stock market reaction to the Challenger crash☆

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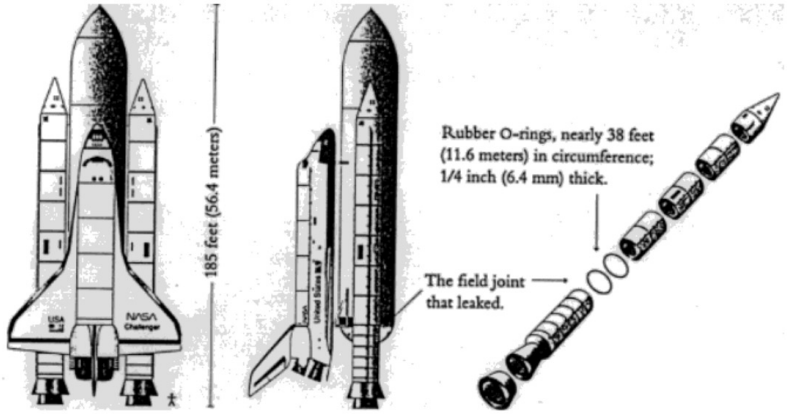
11:39 a.m. eastern standard time on January 28, 1986

Challenger O-Rings

June 1986 report, the Rogers Commission: "lack of resiliency at low temperatures in the seals of the shuttle's booster rockets supplied by Morton Thiokol"



By the end of trading on the day of the event, the stock market had seemingly attributed culpability for the crash to Morton Thiokol

- The firm's 1-day decline of 12% was quick, permanent, and reasonably corresponds to the subsequent losses in terms of legal liability, repair costs, and lost future business.

- By contrast, the other firms involved in the shuttle program suffered only temporary stock price setbacks that recovered for the most part by the end of trading on the day

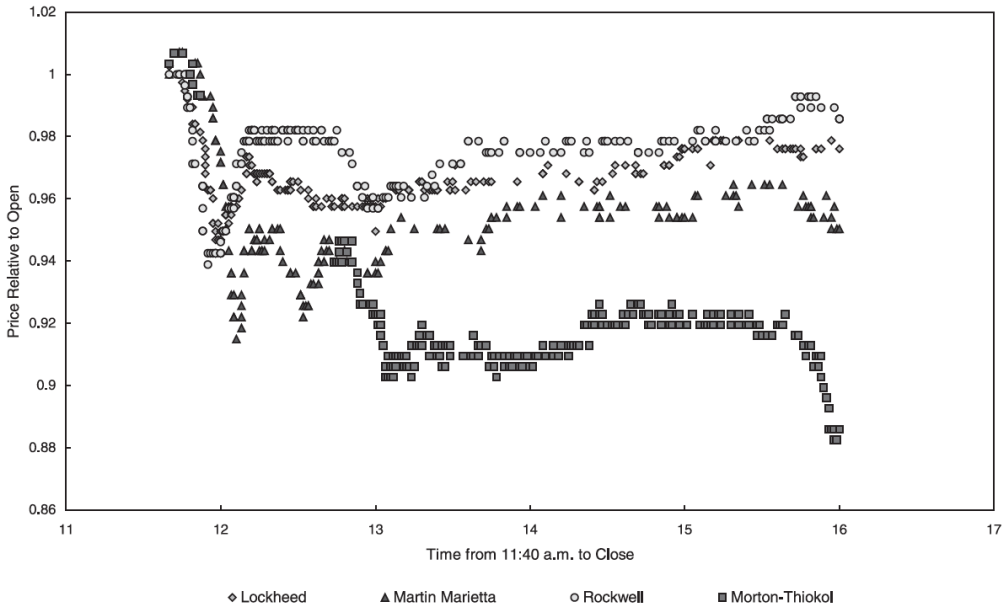


Fig. 1. Intraday stock price movements following the challenger disaster.

Principle5: Price shall reflect information
But what information?

- It took several months for an esteemed panel to determine which of the mechanical components failed during the launch
- Price discovery occurred without large trading profits and that much of the price discovery occurred during a trading halt of the firm responsible for the faulty component
  - *announcement of the crash came across the Dow Jones News Wire at 11:47 a.m – but only about the disaster, not discussing the ground*

- Although the problem of the O-rings was known to some, it was not public information
- Data show no evidence of trading by insiders on January 28, 1986

Price movements and stock returns of the four major space-shuttle firms immediately signals: Principle5 holds!

There is no reported price for Morton Thiokol at noon because of an NYSE trading halt in that stock from 11:52 a.m. to 12:44 p.m. The first post-crash trade in Morton Thiokol occurred at 12:36 p.m.

Data shows clearly, that only one firm was affected; even though there was no common knowledge.

Intraday stock market behavior around the Challenger crash

Time	Morton Thiokol	Lockheed	Martin Marietta	Rockwell International
Panel A. Stock price movements				
11:30 a.m.	US$37.25	US$47.25	US$35.38	US$34.75
Noon	Halt	US$44.50	US$34.25	US$32.75
12:36 p.m.	US$35.00	US$45.00	US$32.50	US$34.13
1:00 p.m.	US$34.38	US$45.00	US$33.00	US$33.25
Panel B. Stock returns				
11:30–Noon	Halt	−5.82%	−3.18%	−5.76%
Noon–12:36	−6.04%	1.12%	−5.11%	4.20%
12:36–1:00	−1.79%	0.00%	1.54%	−2.56%

Market efficiency strikes back!

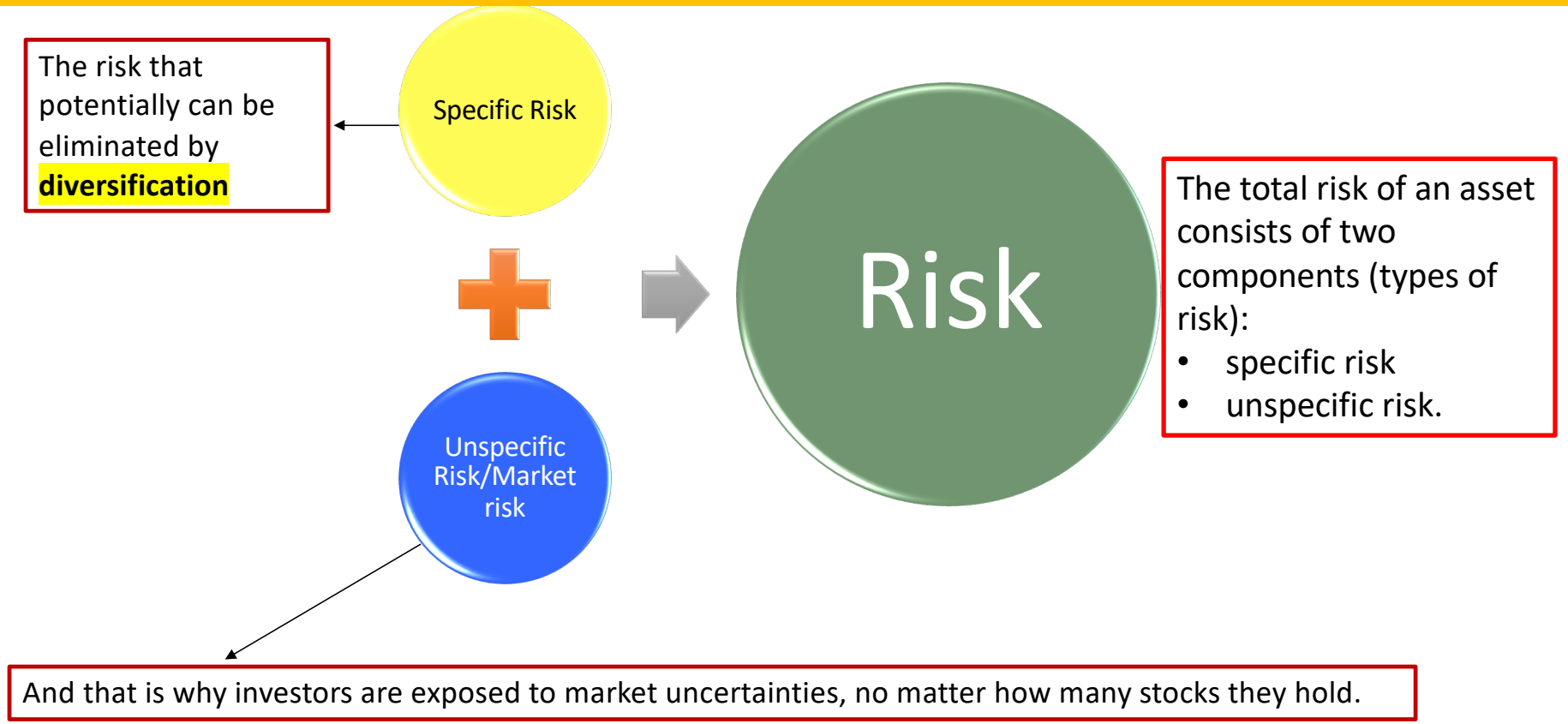
If investors do not rationally process information, then markets may not accurately reflect even public information (*recall: EMH states that securities prices "accurately reflect" […]*)

- **Market Inefficiency**: Markets are assumed to make mistakes in pricing assets across time, and are assumed to correct themselves over time, as new information comes out about assets

If there did exist simple profitable strategies, then the strategies would attract the attention of investors, who by implementing their strategies would compete away the profits.

Thus, financial markets are **likely to be efficient**, at least in the semi-strong form.

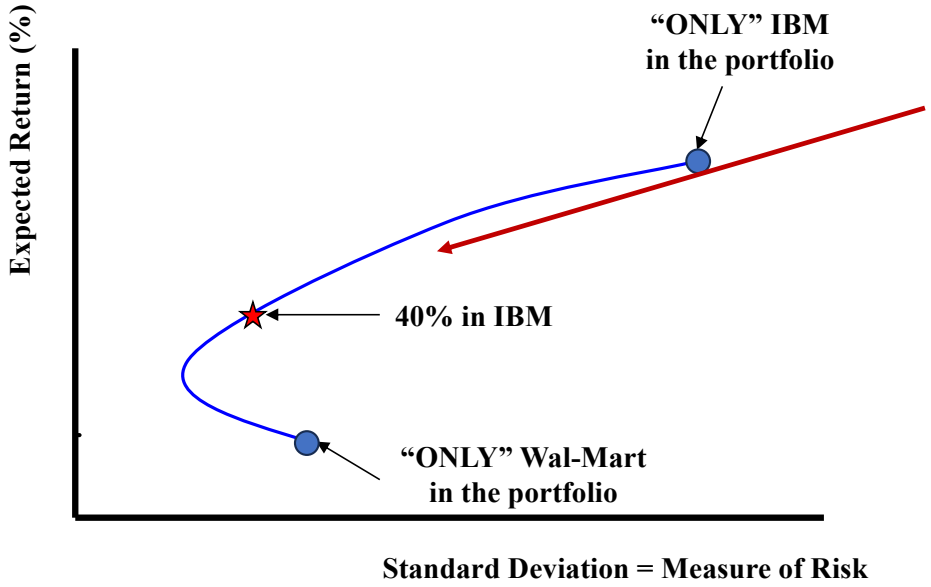
Conceptualizing "Risk" for Finance



The effects of diversification is graphically represented by the efficient frontier = constituting efficient portfolios based on different asset weights

Key finding #1: Expected Returns and Standard Deviations vary given different weighted combinations of the two stocks

Key finding #2: Returns are dependent on the investment combinations that make up the portfolio.



The various weighted combinations of stocks on the blue line, i.e. curvature, constitute the set of ***efficient portfolios***.

These are portfolios that offer the least risk for a given level of return and the highest return for a given level of risk.

Rational investors are only willing to hold efficient portfolios.

What happens to our portfolio performance, if we decide to invest at the **risk-free rate?**

In Finance, the risk-free rate is defined as the rate of return (yield to maturity) offered by **short-term government bonds**

- The short-term typically refers to government bonds with **TTM of less than one year**
- Common example of the risk-free rate of return: YTM of **US government Treasury bills**

In the context of risk-free investments, we introduce two important investment decisions:

We are **lending** at the risk-free rate if we invest in US Treasury bills (i.e. we buy some Treasury bills)

We are **borrowing** at the risk-free rate if we can get a loan from the bank at the risk-free rate

What happens to our portfolio performance, if we decide to invest at the **risk-free rate?**

Let us either borrow or lend on a risk-free rate, thus we assemble **new portfolios**

As we already know:

- The return on these new portfolios is a weighted average of the return of the risky portfolio and the return of the risk-free asset
- The risk of these new portfolios is:

$$\text{Portfolio Variance} = x_1^2\sigma_1^2 + x_2^2\sigma_2^2 + 2(x_1 x_2 \rho_{12}\sigma_1\sigma_2)$$

Since the risk-free asset has by definition zero risk, if X_2 is the fraction invested in the *risk-free asset* and σ_2 is *the risk of the risk-free asset*, then **risk of my new portfolio becomes (eq ?)**:

$$\text{New Portfolio Variance} = x_1^2\sigma_1^2$$

Thus: risk is directly proportionate to the level of risk of the risky portfolio

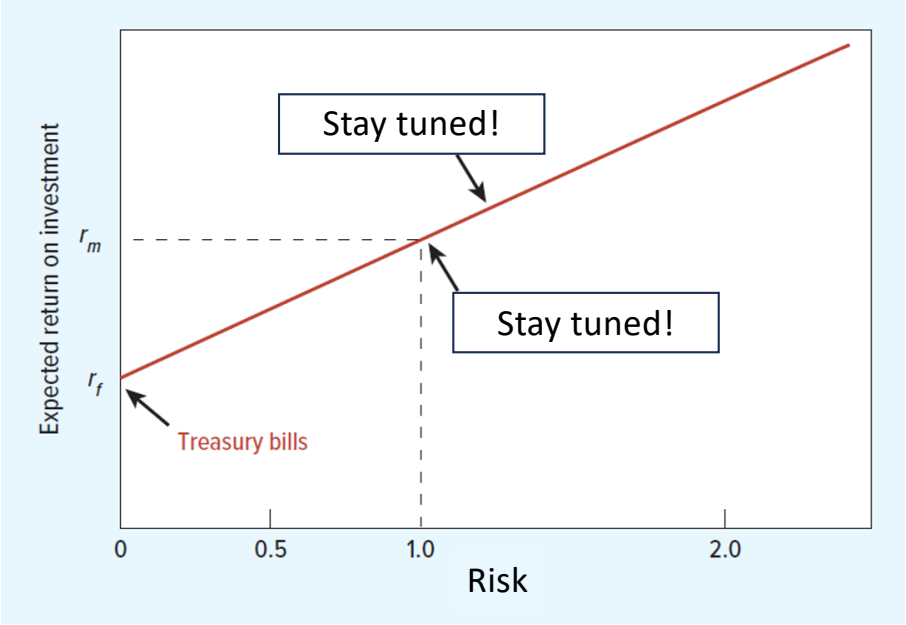
And so: Efficient Frontier is as well our foreword to Capital Asset Pricing Theory and Model (CAPM)

Food for thought: If my portfolio was holding one **risk-free** asset and another, risky asset(s), my claim is that my efficient frontier would transform into a **straight line**

Why?

Sub-questions:

1. Again: What is the "measured risk" of a risk-free asset?



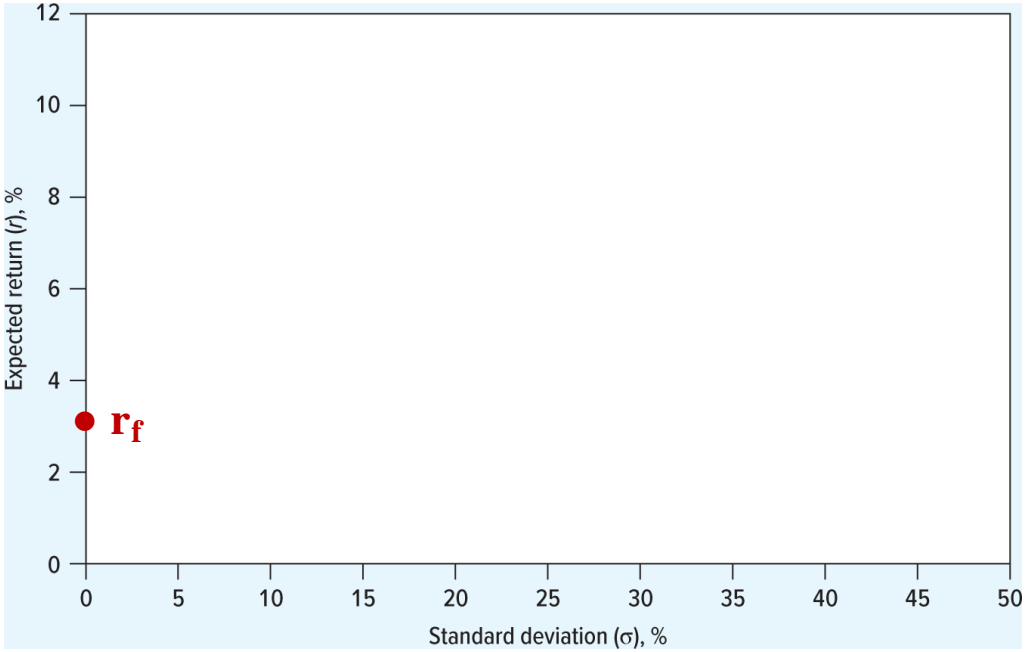
Our efficient frontier transforms into a straight line, if we decide to additionally invest at the **risk-free rate**

It is a linear function, since:

- The return is directly proportionate to the returns of the two assets (**weighted sum**)
- The risk is directly proportionate to the level of risk of the risky portfolio (**one variable!**)

How to construct the linear function?

1. We need to know the crosspoint at Y axis
2. We need to know the slope



1: Crosspoint

Standard deviation is zero. Is there a return?

Our efficient frontier transforms into a straight line, if we decide to additionally invest at the **risk-free rate**

This is basically a linear function, right?

- The return is directly proportionate to the returns of the two assets (**weighted sum**)
- The risk is directly proportionate to the level of risk of the risky portfolio (**one variable!**)

How to construct the linear function?

1. We need to know the crosspoint at Y axis
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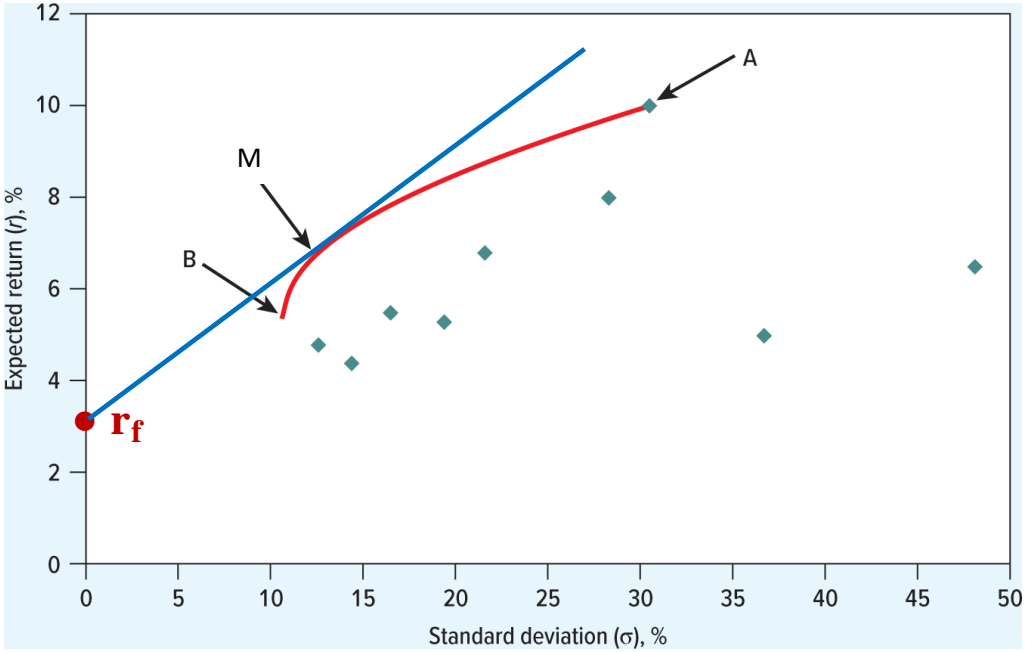


2: Slope:

We want to find the best efficient portfolio (lowest risk and highest return), thus we optimize between having risk-free asset only and holding risky asset only.

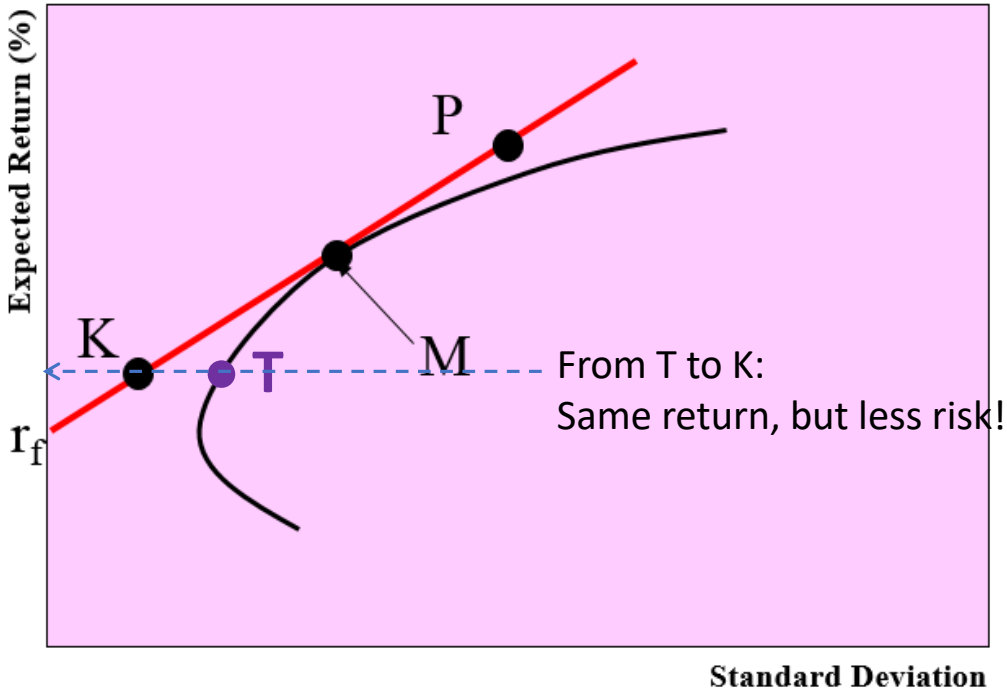
Consequently: Lending or Borrowing at the risk-free rate (r_f) allows us to "exist" outside the old efficient frontier

To sum up

The new efficient frontier is a **straight line** as the risk-free asset has a standard deviation of zero.

- It shows all the different possible combinations between portfolio M and the risk-free asset.

It allows all investors to **improve** their risk and return position by lending (**K**) and borrowing (**P**), i.e. to "move" along the red line by changing the percentages invested in the risk-free asset and portfolio M.



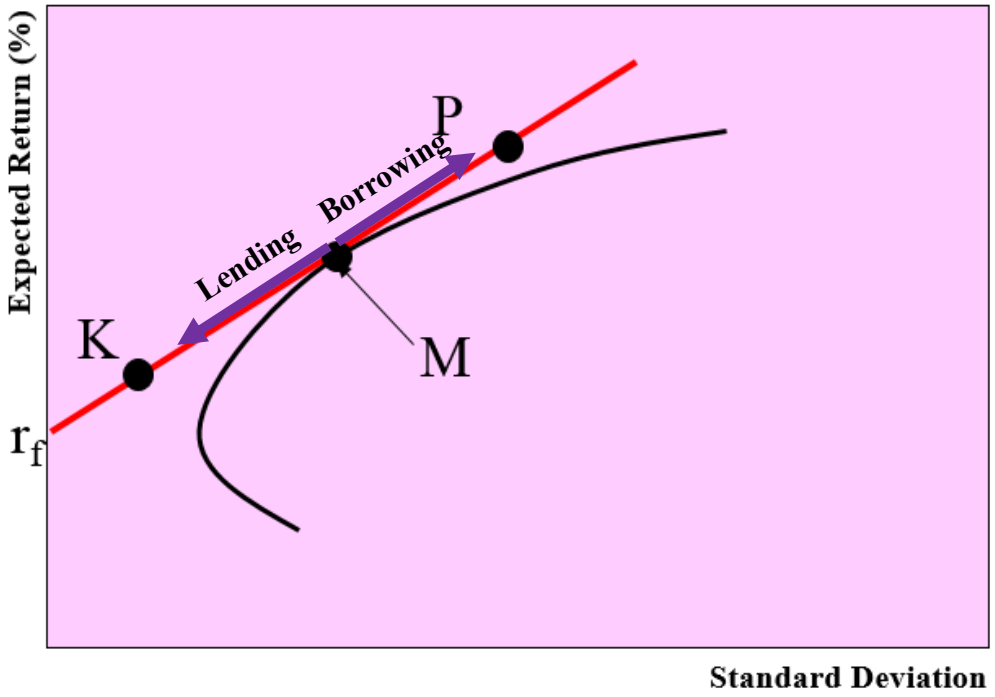
Consequently: Lending or Borrowing at the risk-free rate (r_f) allows us to "exist" outside the old efficient frontier

And so, the following interpretations hold:

1. At points between r_f and M we are **lending** at the risk-free rate
2. At points beyond M we are **borrowing** at the risk-free rate.

Rational investor wants to hold only combinations between portfolio M and the risk-free asset ~~**(why?)**~~

The specific position on the straight line depends or the risk preferences of the investor.



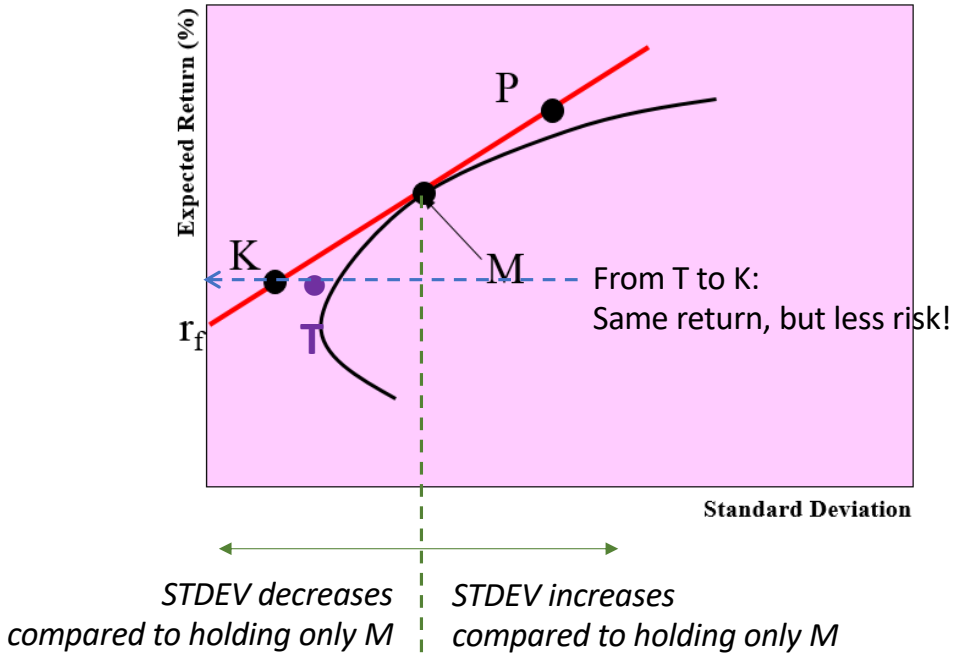
We arrived at CAP Theory by adding a risk-free investment to our portfolio. **Note**: We **do not change the risk** profile of our investment!

The efficient portfolios of risky assets were forming our curvature, that we coined as our **efficient frontier**.

The efficient frontier of my portfolio having a risky and a risk-free asset is a **straight line** as the risk-free asset has a standard deviation of zero.

- It shows all the different possible combinations between portfolio M (that I treat as one, combined asset) and the risk-free asset.

It allows all investors to **improve** their risk and return position by lending (**decreasing overall risk**) and borrowing (**increasing overall risk**), i.e. to "move" along the red line from portfolio M toward **K** or **P** by changing the percentages invested in the risk-free asset and portfolio M.

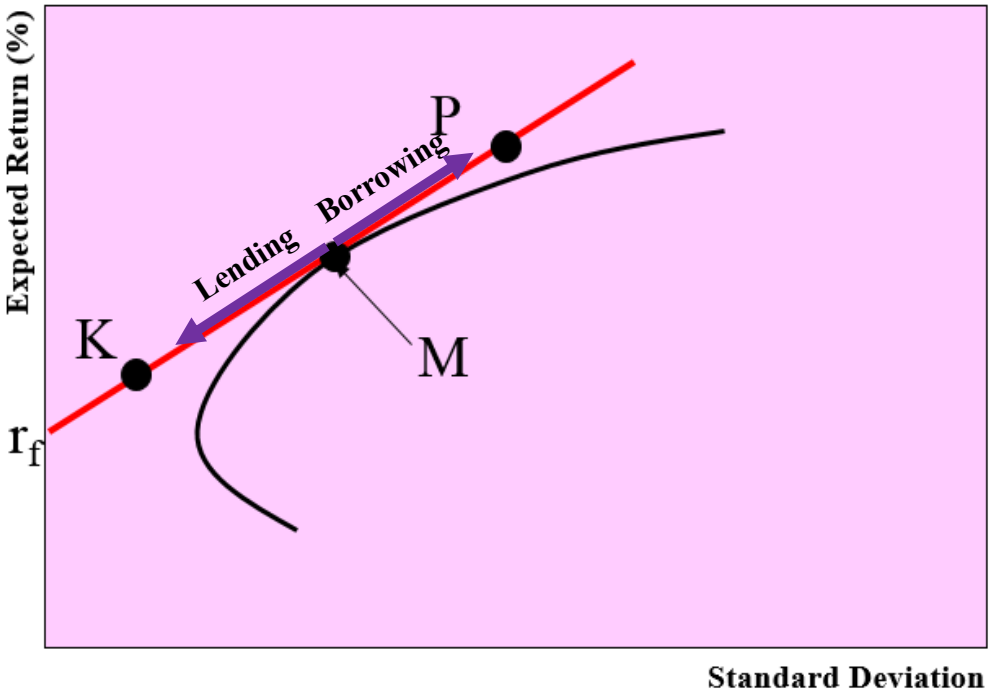


But: According to EMH, all investors want to hold the efficient portfolio, i.e. maximizing return with minimizing risk

If **everyone** holds combinations between the risk-free asset and portfolio M, then by definition portfolio M must be the optimum that all investors go for.

According to EMH, investors have access to the same information. Thus, it is unlikely to come up with a superior investment idea (in equilibrium).

We coin Portfolio M as the **market portfolio**, i.e. the **efficient combination** between the risk-free asset and the risky portfolio, if M consists of **all the risky financial assets** in the economy.



Capital Asset Pricing Model (CAPM) would in return help investors addressing security risk

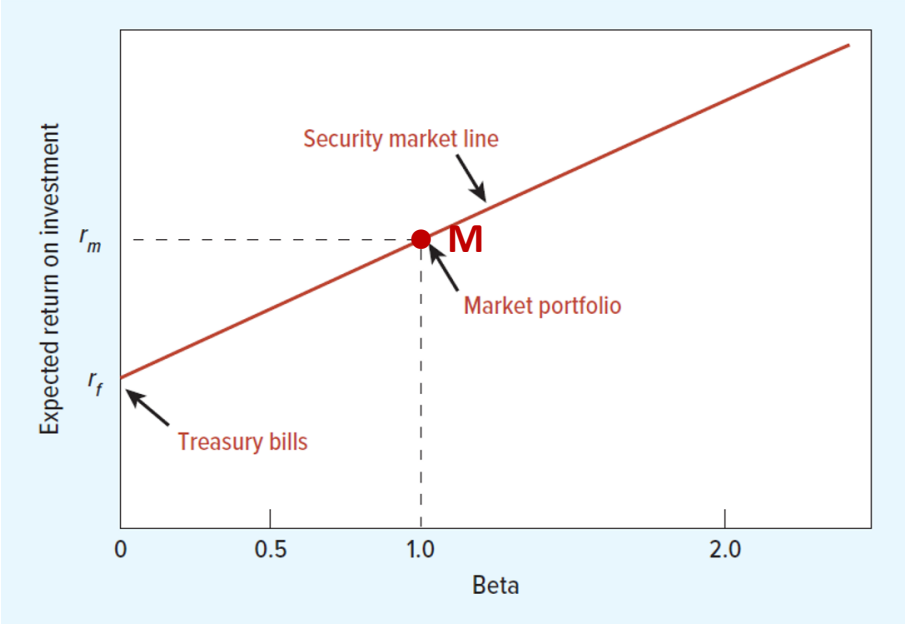
The only relevant risk when we hold portfolio combinations between the risk-free asset and the market portfolio is the **unspecific/market risk** which is measured by **beta**.

The beta of the market is equal to 1

Thus:

1. r_m = return of the market portfolio
2. r_f = return of the risk-free asset
3. X axis is the measure of beta, which equals 1 for the market portfolio

We have another linear function!



Capital Asset Pricing Theory and Model (CAPM) describes, how the beta of an investment relates to its expected rate of return

The key insight here is that investors will require a **higher rate** of return on investments with **higher betas**

$$r_i = r_f + \beta_i \times \left(r_m - r_f \right)$$

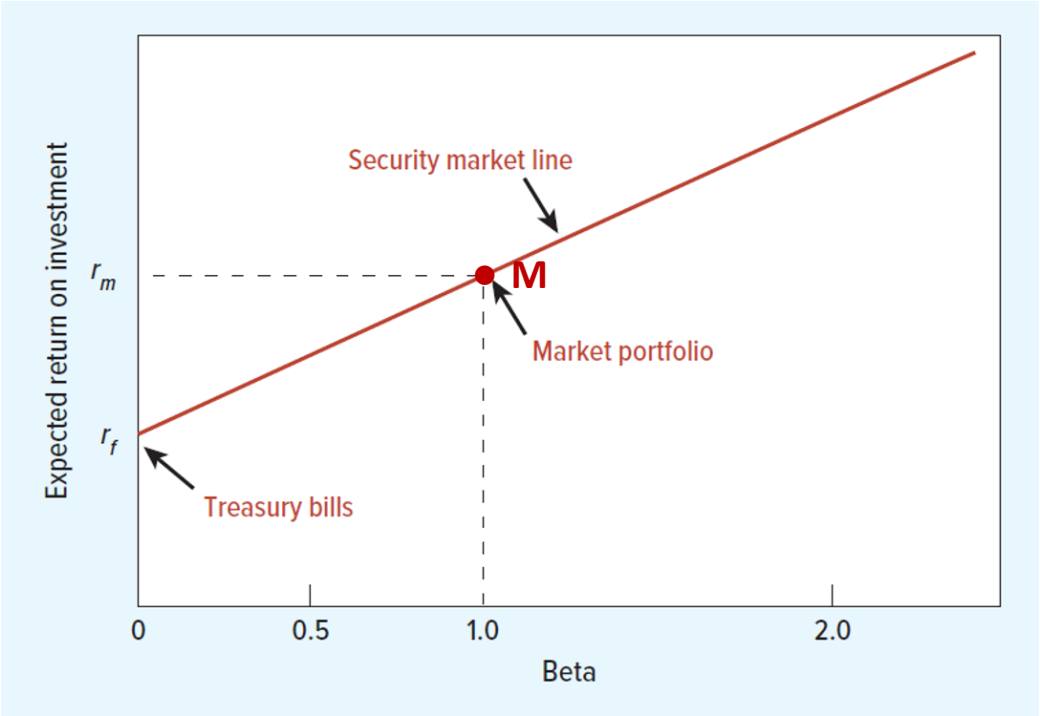
Where

r_i = investment's expected return

r_f = risk-free return

r_m = market return

r_m-r_f = market risk premium



Based on CAPM, what is the expected return?

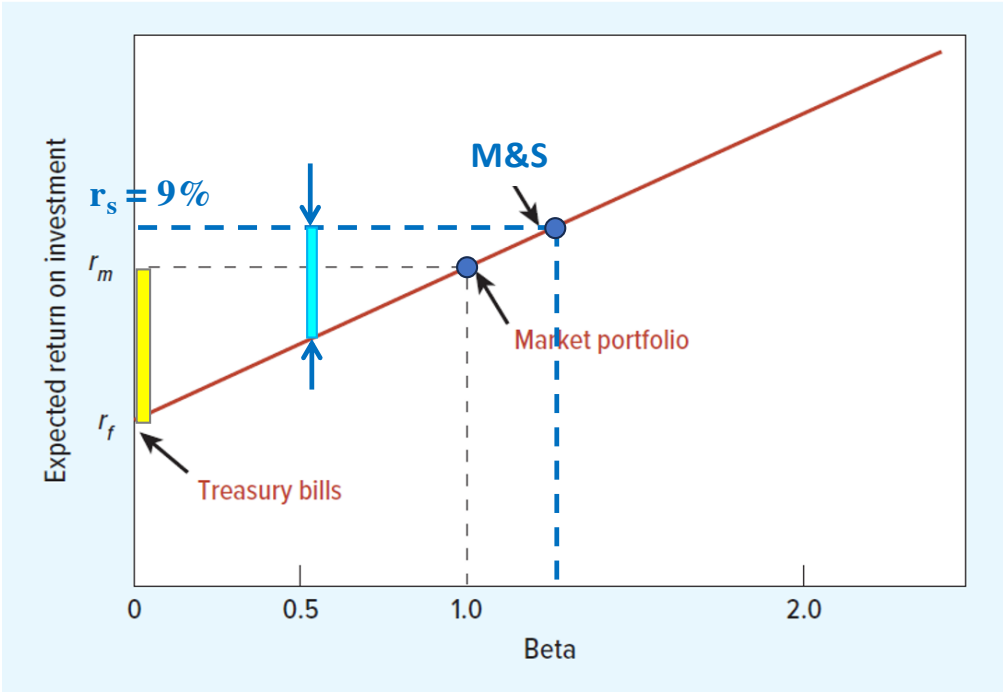
I am considering buying Marks & Spencer stocks. I assume the market return is expected to be, 8%, the YTM on T-Bills is 3%. Marks & Spencer's Beta is 1.2.

- **Question:** What is my expected return?

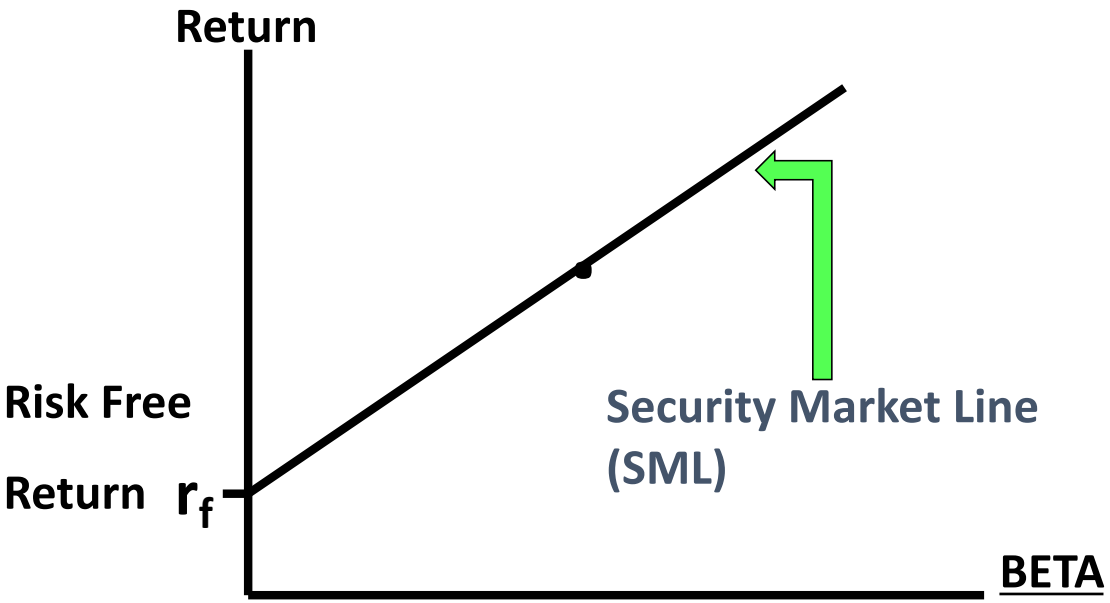
$$r_s = r_f + \beta (r_m - r_f)$$

M&S = 3 + 1.2 (8-3) = 9 %

Investment's risk premium: 9% - 3% = 6%
Market risk premium: 8% - 3% = 5%



Capital Asset Pricing Model (CAPM) allows us to determine the **fair** price of securities(!)



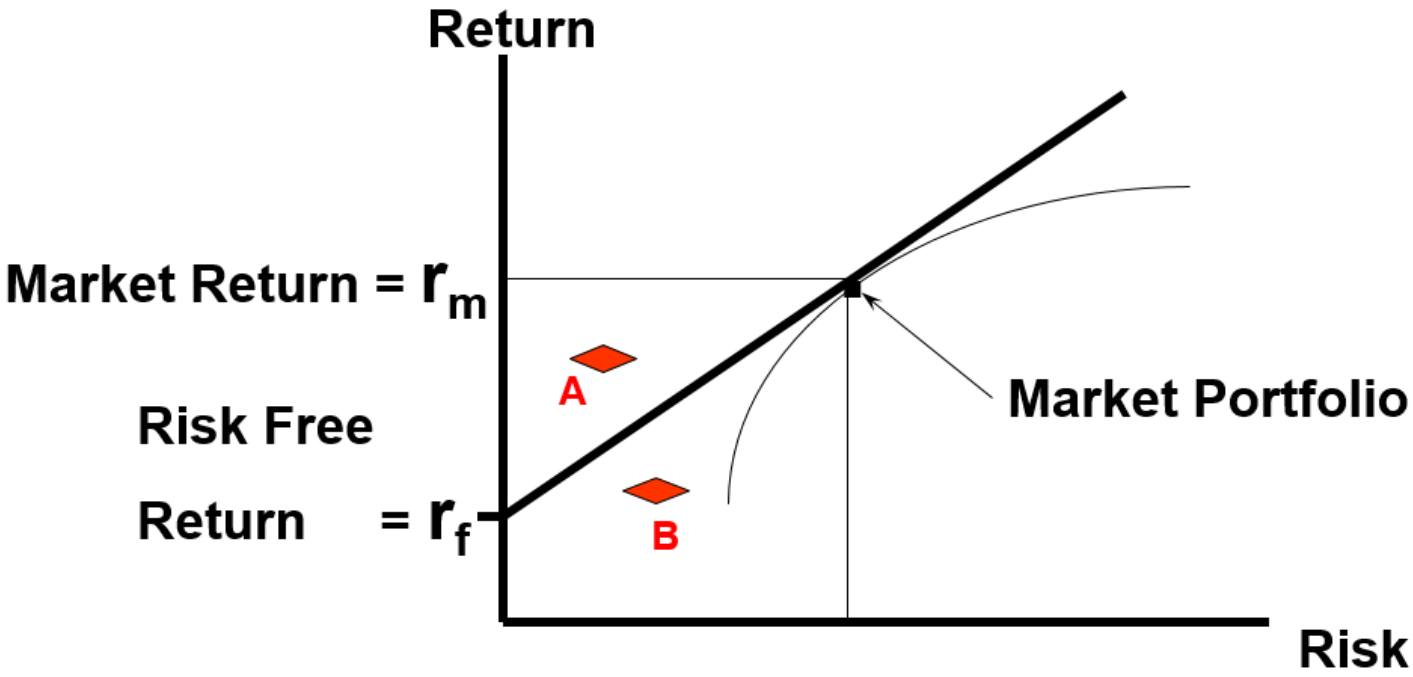
In equilibrium, all stocks should plot on the **Security Market Line** (SML). The SML displays the expected return of an individual security as a function of unspecific risk (beta).

When stocks plot on the SML they are **correctly priced**

Stocks which plot **above** the SML: under-priced

Stocks which plot **below** the SML: over-priced

Shares A and B offer the risk and return indicated. Which one would you buy, which one would you sell?

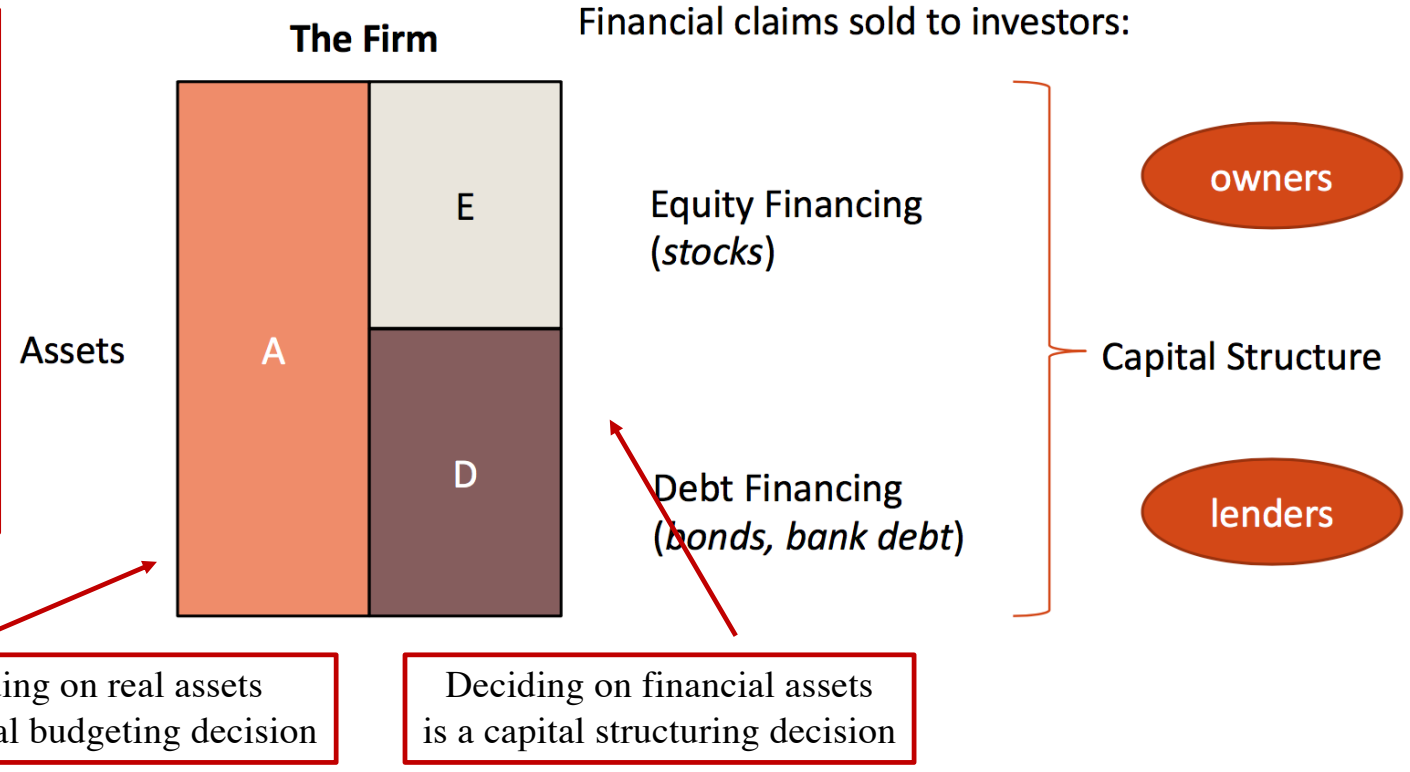


Markets as source of funding
Corporations raise money via financial claims

Recall the slides of Lecture1:

Real assets:
Contribute directly to my operation;
I (re)invest to mainitain it

Financial assets:
A contractual relationship, a promise I make to raise capital, and a promise I must keep



Valuing a Business in Practice

There are situations when we want to find the “true” value of the entire business

- Buy or sell entire businesses? “Pricing in” the stock for an IPO?

If a company is listed, we are “fine”, we use expected dividends per share for fair pricing.

If a company is not yet listed?

- We still follow the same logic but instead of using the expected dividends per share we immediately recall Principle3 and….
- Use the total free cash flow of the business

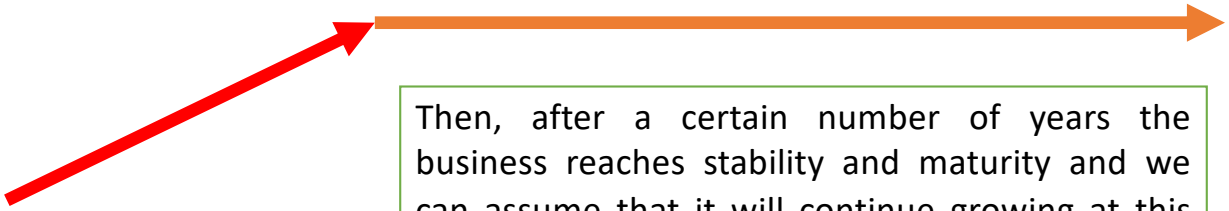
The free cash flow in any given year is the amount that’s left in the business after we have made all the necessary investments for growth

In reality businesses have different stages of development

For simplicity, we will assume that businesses have TWO main stages of development

- The first stage represents the foreseeable future and the second stage is from the end of this foreseeable future period until eternity.
- For simplicity, we will also assume that these two stages are the
- HIGH GROWTH STAGE (expands rapidly and re-invests)
- STABLE/SUSTAINABLE GROWTH STAGE (i.e. mature stage, grow at a lower, stable and sustainable rate)

Every, so far studied calculation strategy for valuation would dictate that the “true value” we are looking for is the **sum** of the individual values of stages



Graphically, the red line represents the high-growth period, this is the value of the business during the foreseeable future.

In practice, a financial manager would calculate with a time horizon to limit the growth period.

Then, after a certain number of years the business reaches stability and maturity and we can assume that it will continue growing at this sustainable, stable growth rate forever.

It is also practical to assume this when we want to value a businesses as we cannot keep forecasting the company’s cash flows into eternity…!

We assume that the company will continue to grow at this stage in PERPETUITY.

Time horizon? Which formula for stock valuation contains a horizont?

Valuation under changing market characteristics influence management decisions

Capital budgeting (investment) decisions are “how to spend money” problems

Financing the capital investments are “how to raise money” problems

- If the firm needs more capital, should it issue more stock or should it borrow again?

- Equity financing? But how many shares to issue, and what is the fair price?
- Debt financing? But how much debt? Should it borrow short term or long term?

- Should the firm reinvest most of its earnings in the business, or distribute the cash to shareholders?
- Is it better to distribute cash to stockholders by paying out dividends or by repurchasing stock?

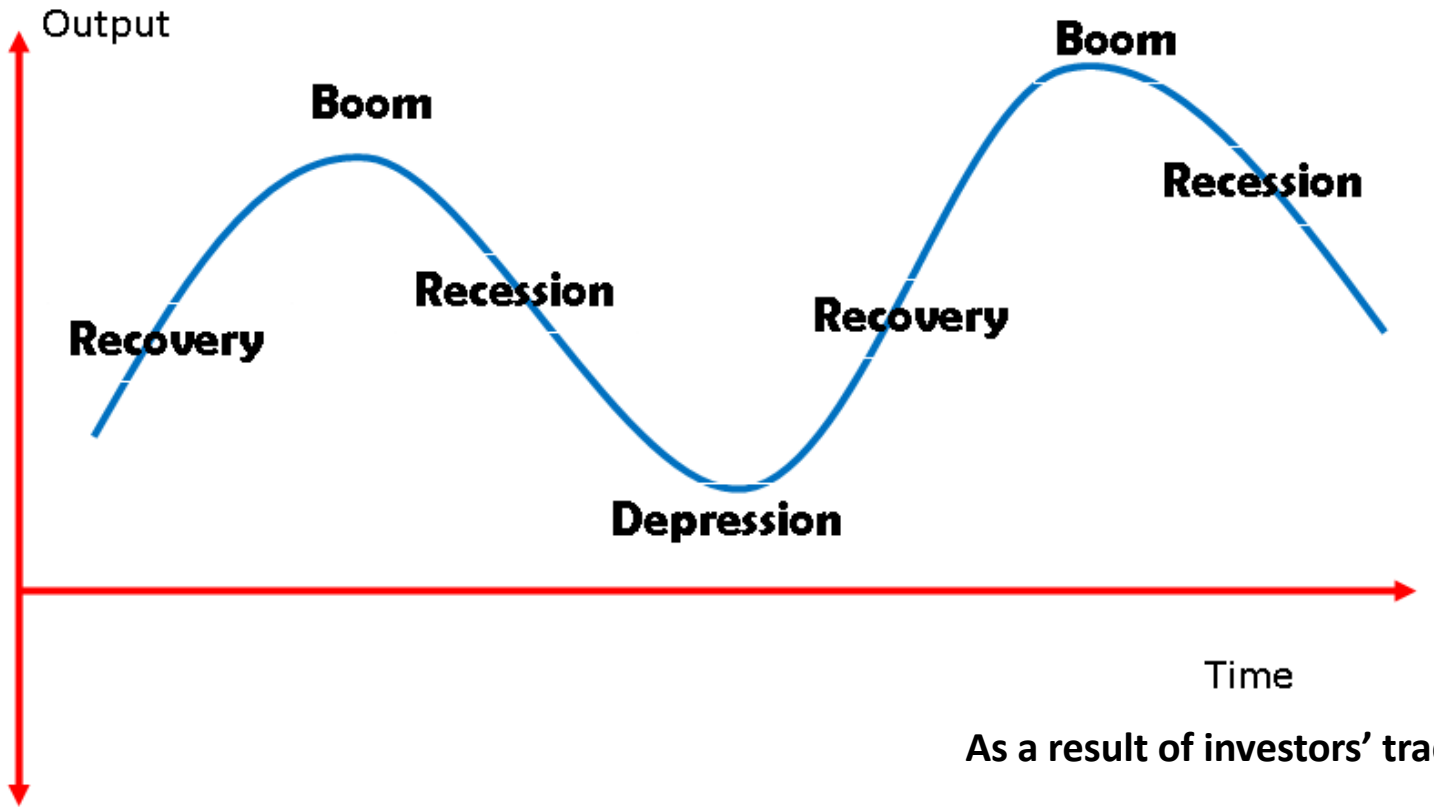
Changing market characteristics influence capital structuring decisions

I want to avoid market turbulence, work against Beta and opportunity costs (of capital).

I also want to create the perception of a stable growth and management

Industry– seasonality (short-term fluctuation), cyclicality (long-term fluctuation)	**Maturity-** growing, stable, cash generative	**Ownership (Control) –** strategies for control	**Others??** -tangible assets? -utility firms? -macroeconomic condition?

Changing market characteristics influence capital structuring decisions



As a result of investors' trading behavior!

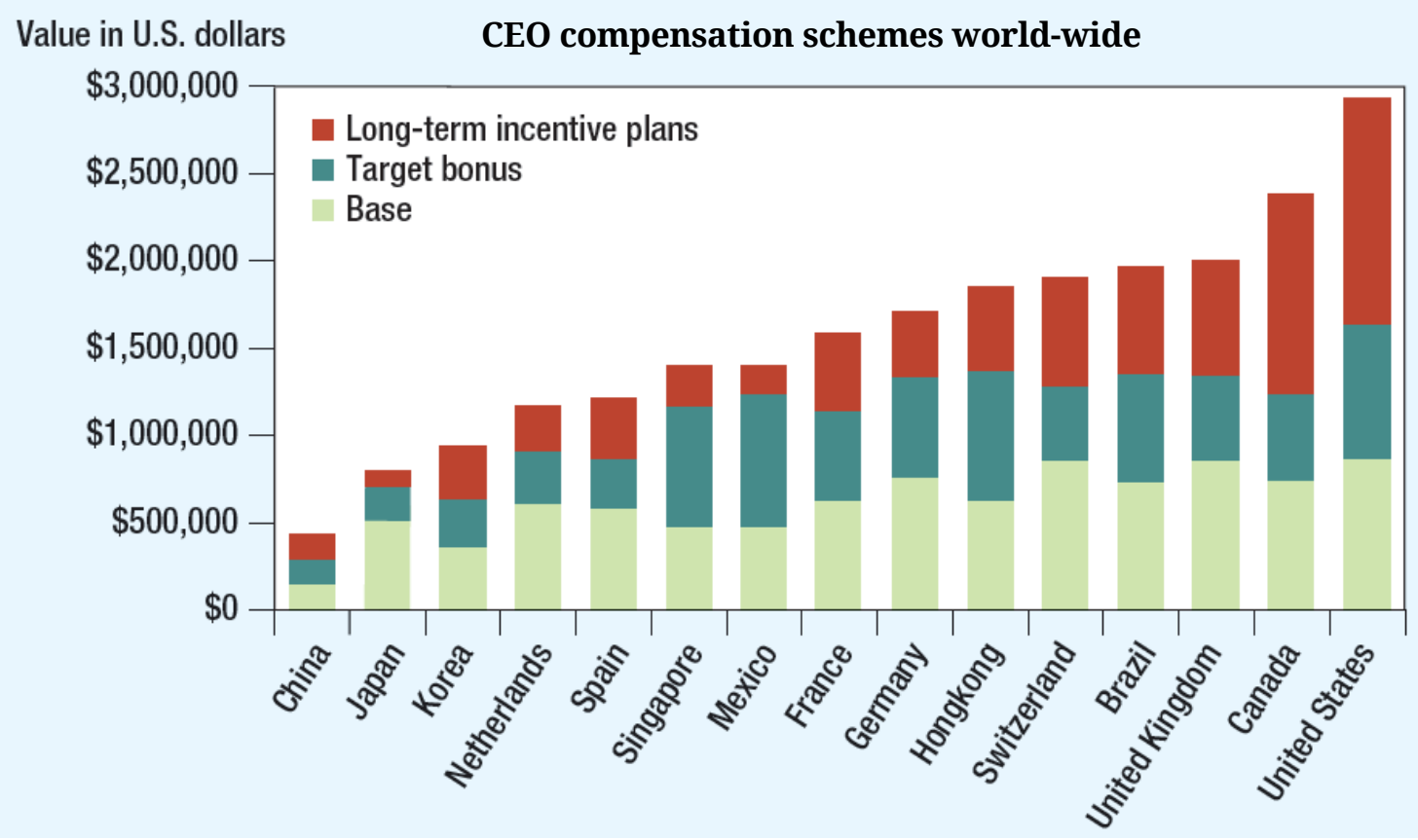
Recall the Principal-Agent Problem:
The goal is to get everyone working together to maximize value

Shareholders = Owners
Principal

Managers = Employees
Shareholders' Agents

Question: Who has the decision-making power to maximize firm value?

Managers' "textbook-responsibility" is to maximize shareholder value, so they are incentivized accordingly



Long-term incentive plan
Pension plans
Health insurance
Ownership in the company
Or other types of rewards that are linked to the company's stock price

Bonus
Typically depends on increases in earnings or other accounting measures of performance/profitability

Avoiding market turbulence often calls for reinvestments and for buybacks, i.e. for repurchase of shares

As we argued, firms might decide to pay dividends to investors, but it is a crucial strategic decision

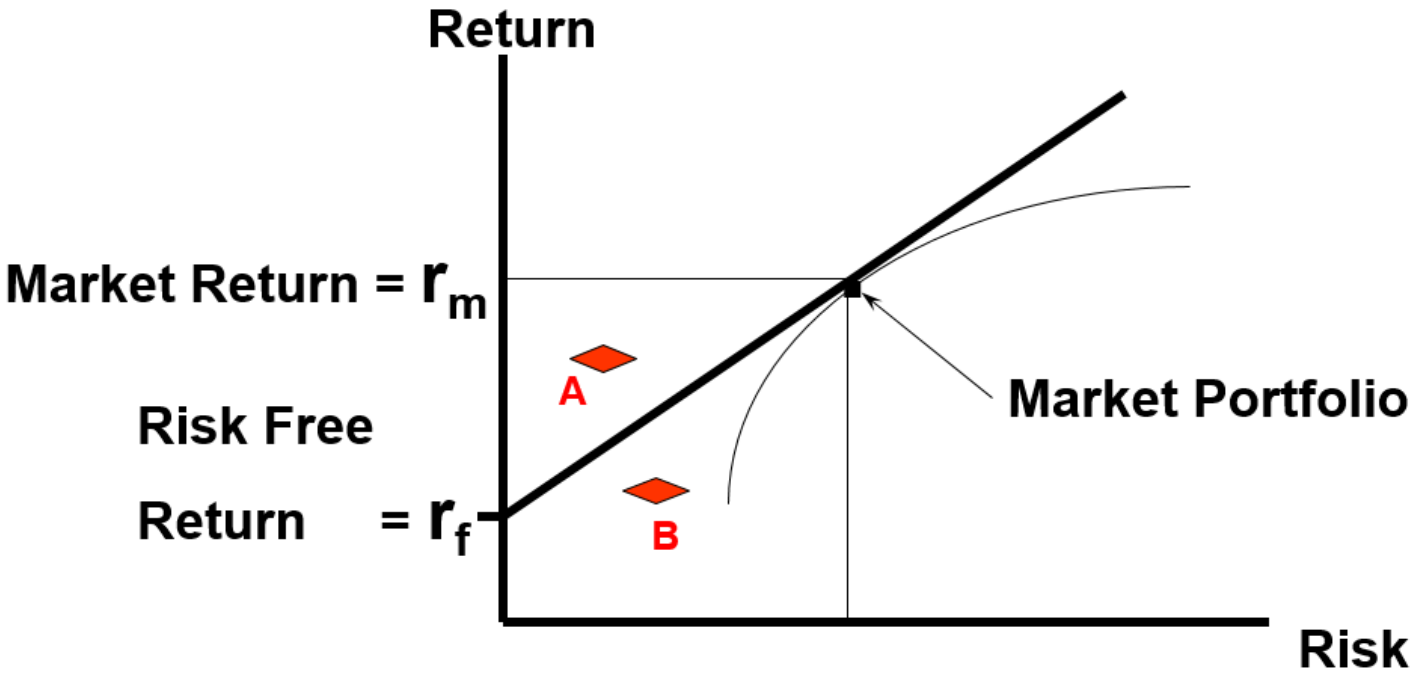
- Investors would like to see tech/innovative industries grow
- Mature, stable firms would prefer paying dividends to keep investors' sentiment

Share buyback (repurchase) is often a strategy to go for, if market turbulence negatively impacts valuation

- It is a form of dividend payment. Why? It returns cash to the shareholders

Question for the manager: What's the impact of buyback on the stock valuation?

Shares A and B offer the risk and return indicated.
When would you consider buyback?



Recall the Tesla-case from Lecture2:
Buyback can become a “manipulative tool” with a severe downside

What are the valuation implications of buyback versus payout? Let us consider MyFirm's example below

Assets		Liabilities	
Cash	£100		
		£100	Common Equity

Before the dividend payment, MyFirm has 100 shares outstanding, each worth £100 / 100 = £1=100p

MyFirm decides to pay £20 as **dividend**; implying -£20 in Cash & -£20 in Common Equity

The number of shares outstanding remains the the same, but share value?

What are the valuation implications of buyback versus payout? Let us consider MyFirm's example below

Assets		Liabilities	
Cash	£80		
		£80	Common Equity

After the dividend payment, MyFirm has 100 shares outstanding, each worth 80p (=£80/100 shares)

MyFirm decides to pay £20 as dividend; implying -£20 in Cash & -£20 in Common Equity

What are the valuation implications of buyback versus payout? Let us consider MyFirm's example below

Assets		Liabilities	
Cash	£100		
		£100	Common Equity

Before buyback, MyFirm has 100 shares outstanding, each worth £100 / 100 = £1=100p

MyFirm offers to **buy** back 20 of its **shares** for £20; implying -£20 in Cash & -£20 in Common Equity

The number of shares outstanding is thus **decreasing**, but share value?

What are the valuation implications of buyback versus payout? Let us consider MyFirm's example below

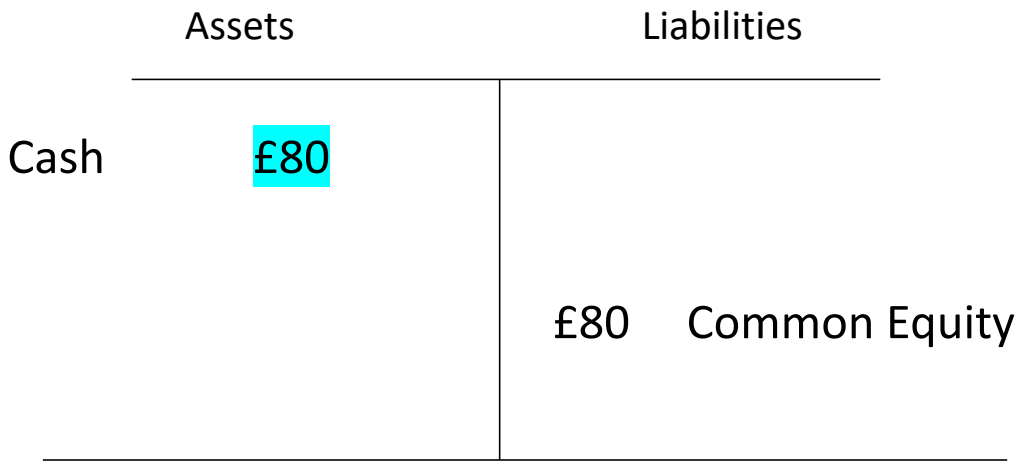
Assets		Liabilities	
Cash	£80		
		£80	Common Equity

After buyback, MyFirm has 80 shares outstanding, each worth 100p (=£80/80 shares!)

MyFirm offers to **buy** back 20 of its **shares** for £20; implying -£20 in Cash & -£20 in Common Equity

There will be fewer shares outstanding, thus proportionally more "value" per share after buyback

Buyback can increase share value, but as an artificial measure
Payout can decrease share value, but signalizes responsibility



After buyback, MyFirm has 80 shares outstanding, each worth 100p (=£80/80 shares!)

After the dividend payment, MyFirm has 100 shares outstanding, each worth 80p (=£80/100 shares)

Both cases leave £80 in cash and £80 in Equity
but the share buyback ALSO reduces the number of shares outstanding

Recall Principle4 and agency costs: Who would benefit from payout, who would benefit from buyback?

Scallop Plc expects to generate net earnings of £10 this year (calculated after deducting any dividend and share repurchase expense), what will be its **earnings per share**?

(D-Tour question: As a financial manager, why to focus at EPS?)

Please consider the two scenarios:

a) paying a cash dividend and number of shares outstanding of 100

b) a share buyback of 20 shares out of 100 shares outstanding

Earnings per Share (EPS) is the function of management decisions

If the company pays a cash dividend this year:

Assume last year's EPS = £10/100=10%

This year's EPS = £10/100=**10%**

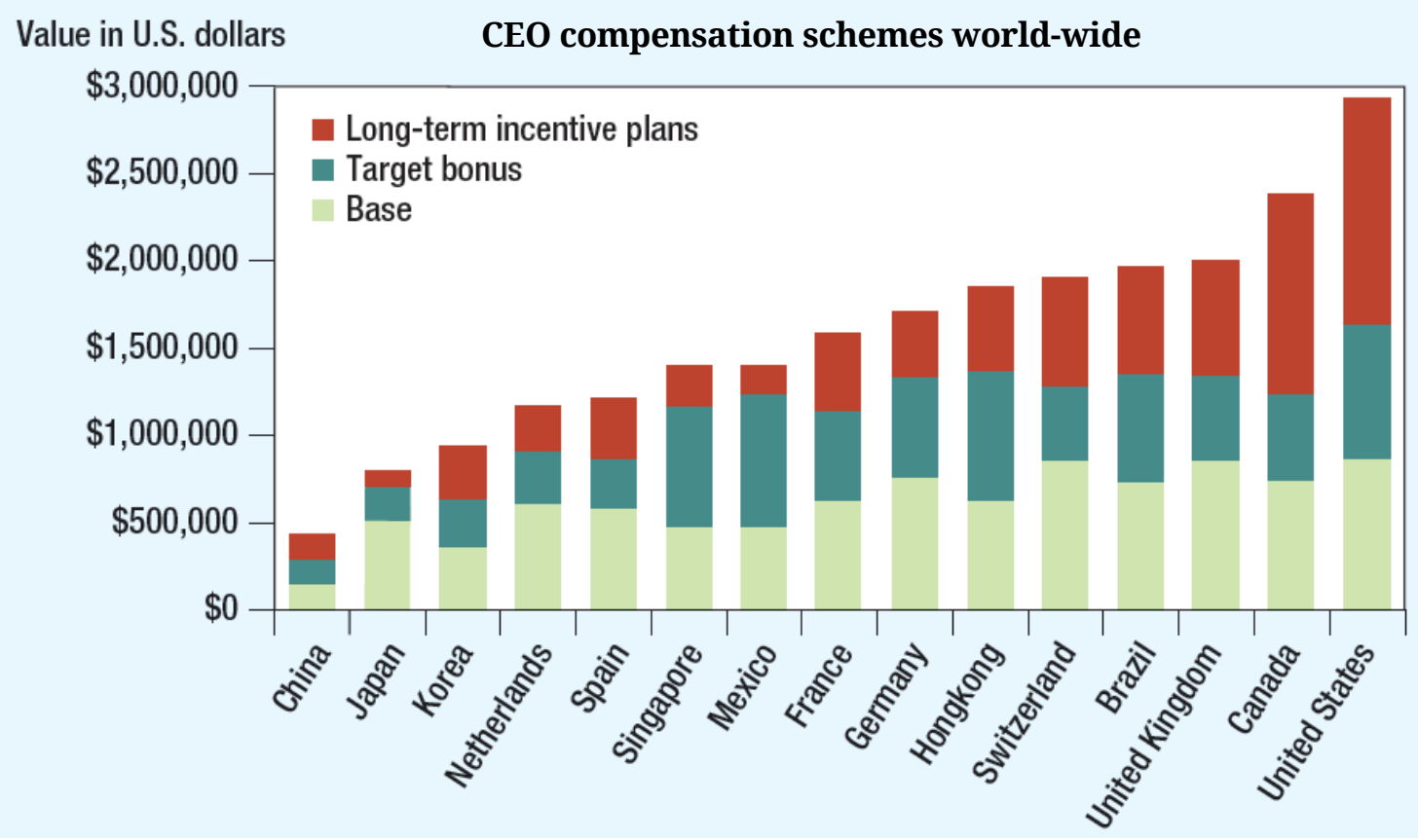
If the company performs a buyback this year:

Assume last year's EPS = £10/100=10%

This year's EPS= =£10/80 = **12.5%**

Buyback can increase share value, but as an artificial measure

Managers' "textbook-responsibility" is to maximize shareholder value, so they are incentivized accordingly



Long-term incentive plan
Pension plans
Health insurance
Ownership in the company
Or other types of rewards that are linked to the company's stock price

Bonus
Typically depends on increases in earnings or other accounting measures of performance/profitability

Should decisions maximize stakeholder or shareholder value?

You are the **CEO** of Scallop Co. and your bonus is based upon increasing earnings per share (EPS).
Would that influence your decision to pay a

1) Cash dividend?
2) Share buyback -> artificially inflating EPS?

You are the **BOD** of Scallop Co.
Buyback reduces the number of outstanding shares on the market, which increases the ownership stake of the stakeholders

You are the **shareholders** of Scallop Co.
Share buyback might be the signal that the corporation does not have other profitable opportunities for growth.

Recall the Principal-Agent Problem:
The goal is to get everyone working together to maximize value
BUT: It is the **stakeholder value** that shall be considered!

Shareholders = Owners
Principle

Managers = Employees
Shareholders' Agents

Question: Who has the power?

Answer: Managers

Financial managers should try as hard as they can to find and execute positive-NPV projects

What is a good investment evaluation tool?
Three points to remember about NPV

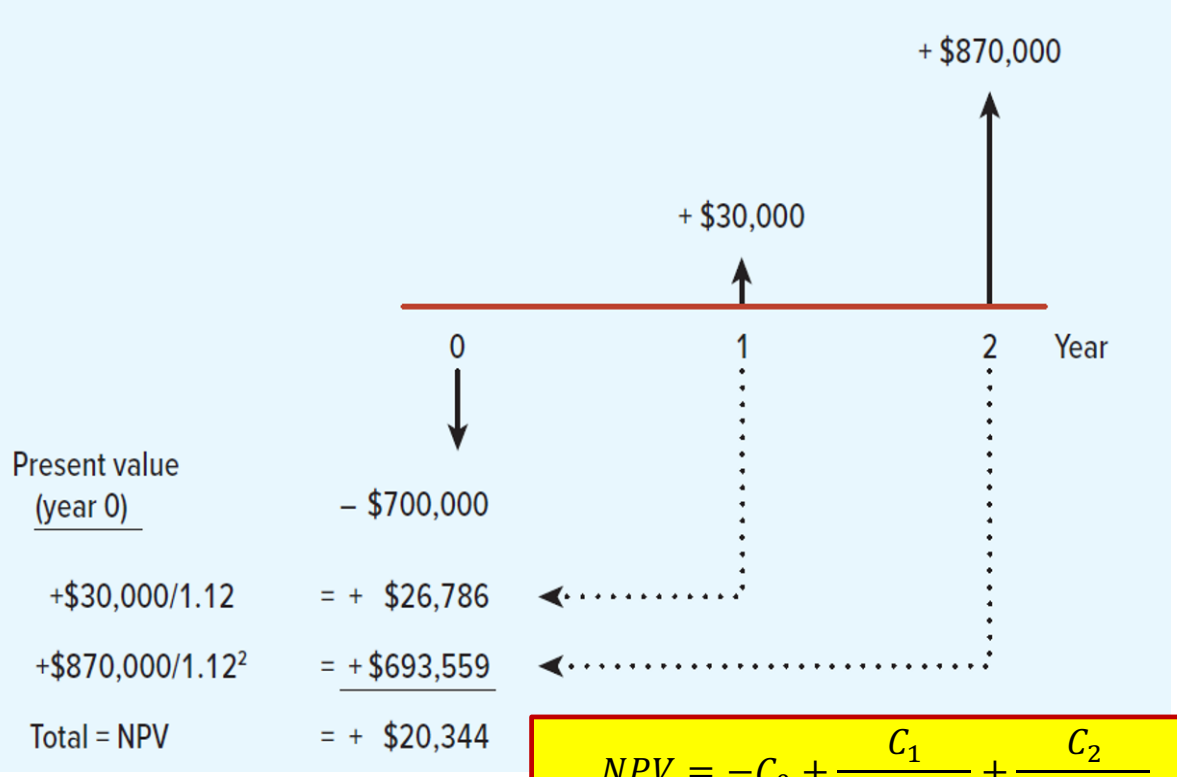
1. The NPV rule offers a **clear benchmark**— accept projects with positive NPV

2. NPV depends solely on the **all** cash flows, none are unaccounted for, considers the time value of money and the opportunity cost of capital (i.e. interest rate)

3. Because present values are **all** measured in today's unit, you can add them up; this is coined as the **Value Additivity Principle**:

$$\mathrm{NPV}\left(\mathrm{A}+\mathrm{B}\right)=\mathrm{NPV}\left(\mathrm{A}\right)+\mathrm{NPV}\left(\mathrm{B}\right)$$

Maybe you recall this slide from Lecture2:



$$NPV = -C_0 + \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2}$$

In this case, you calculate with multiple cash-flows for each year

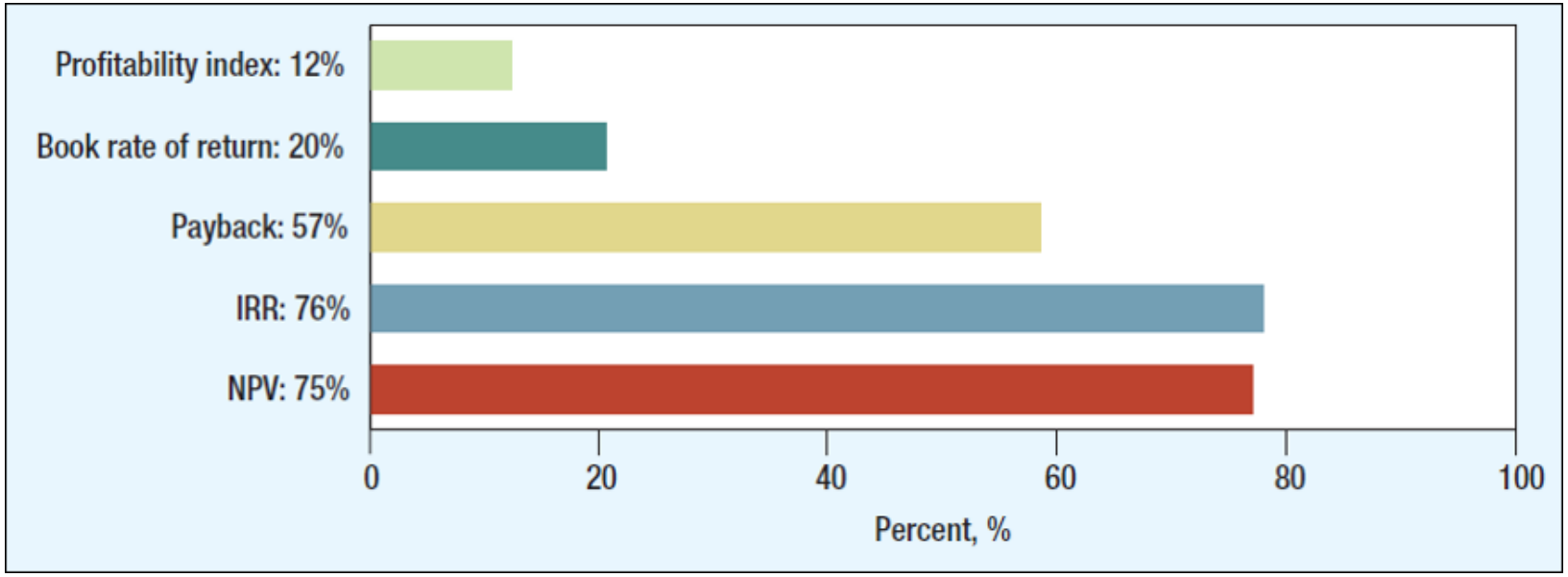
… and you do take care of the selected time reference (today)

$$\mathrm{PV} = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \ldots + \frac{C_t}{(1+r)^T}$$

DCF

$$\mathrm{NPV} = C_0 + \sum_{t-1}^{T} \frac{C_t}{(1+r)^t}$$

CFOs' use of investment evaluation techniques



SOURCE: Graham and Harvey, "The Theory and Practice of Finance: Evidence from the Field," Journal of Financial Economics 61 (2001), pp. 187-243.

We did a lot in this lecture again…

We did again a lot:

- We covered all important aspects and fundaments of asset / portfolio risk

- We continue with discussing firm valuation and enter the world of capital budgeting decisions!

… and so, we finish up our journey in the next lecture!