WELCOME TO
Introduction to Finance
for
MSc Financial Technology and Innovation

Lecture 6

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Recap from last lecture
We did a lot last week, most importantly

(Continuopusly discussing the) Financial system; introduction to financial markets

- Equities and terminology
- Valuing common stocks == PV of a stock
- Dividends, DDM (just as DCF)
- Dividends either remain the same, or grow: Addressing the value of a common stock with constant growth

Your toolset so far:

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

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

DCF

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

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

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

Annual Percentage Rate (APR)

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

Effective Annual Interest Rate (EAR)

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

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

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

Your toolset so far:

- 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(!)

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

$$\text{PV of Growing Annuity} =$$

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

Your toolset so far:

- 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:

- 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)

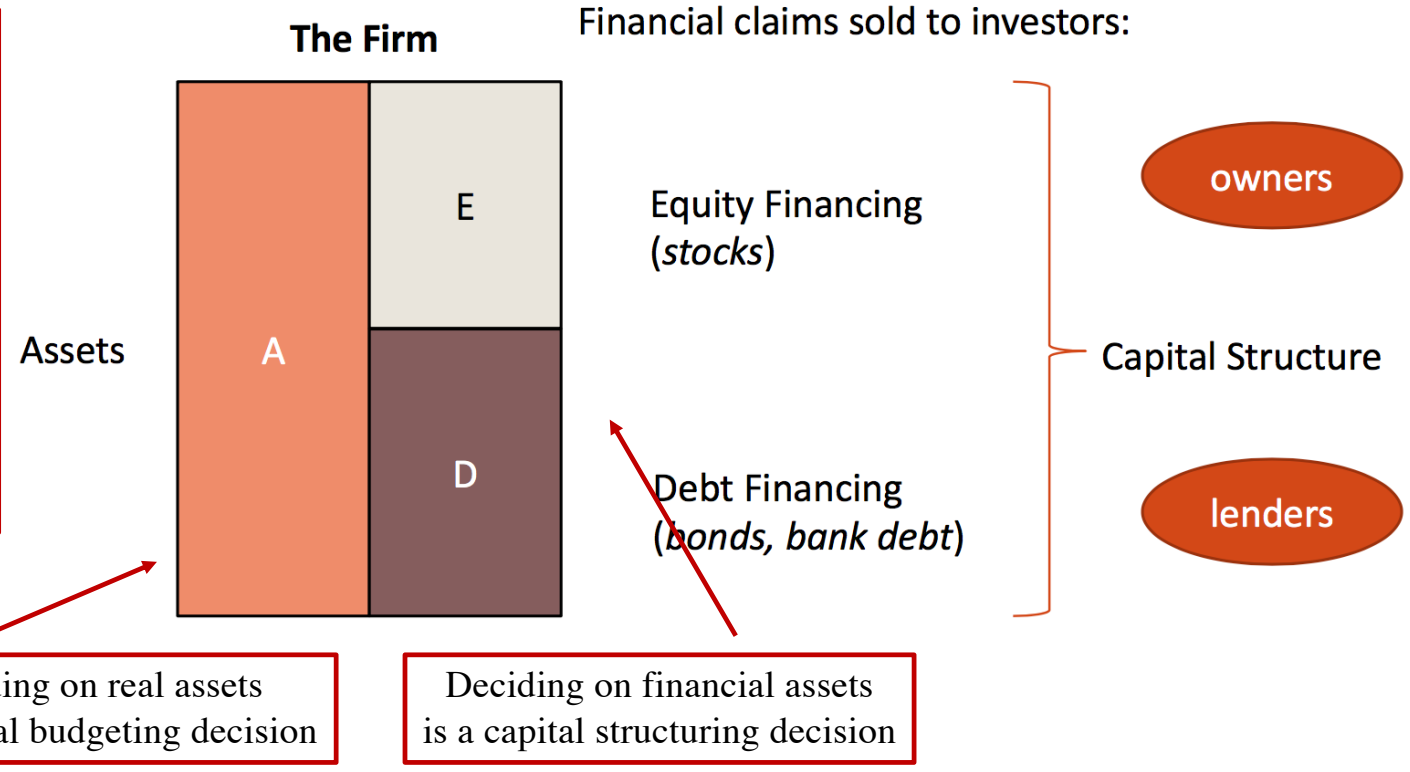
$$PV_0 = \frac{C_1}{r - g}$$

Markets as source of funding
Corporations raise money via financial claims

Recall the slides of Lecture1:

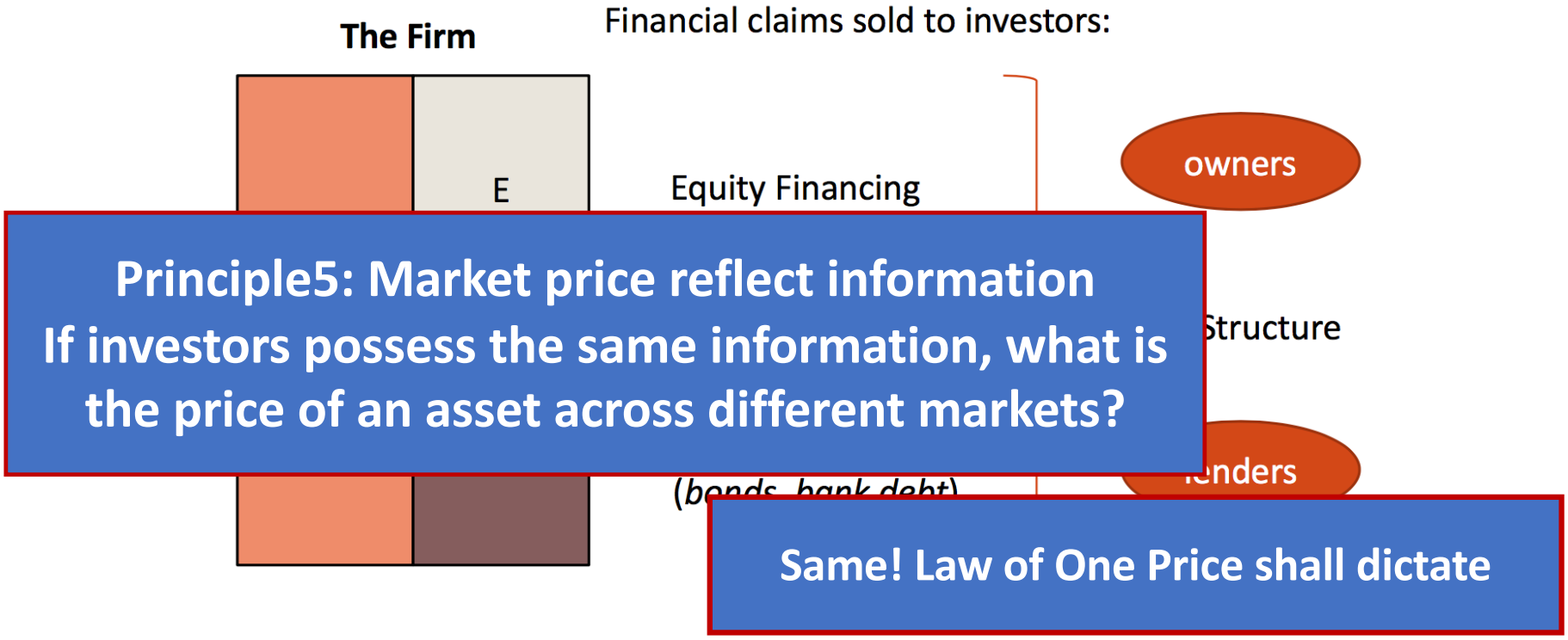
Real assets:
Contribute directly to my operation;
I (re)invest to mainitain it

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



Markets as source of funding

Corporations raise money via financial claims



Consider this statement. True or false?

"*If a company uses more debt to finance a project, it needs less equity.*

Therefore, the required rate of return on equity, that investors would ask for, is lower."

- Is this statement true or false?

No, the statement is incorrect.

More debt means financial stress, i.e. fixed cost to calculate with (Principle 3: cash flows are the source of value), increasing therefore the risk for investors. Higher risk asks for higher return, as Principle 2 would dictate.

Recap on bonds:
Please consider the following two statements

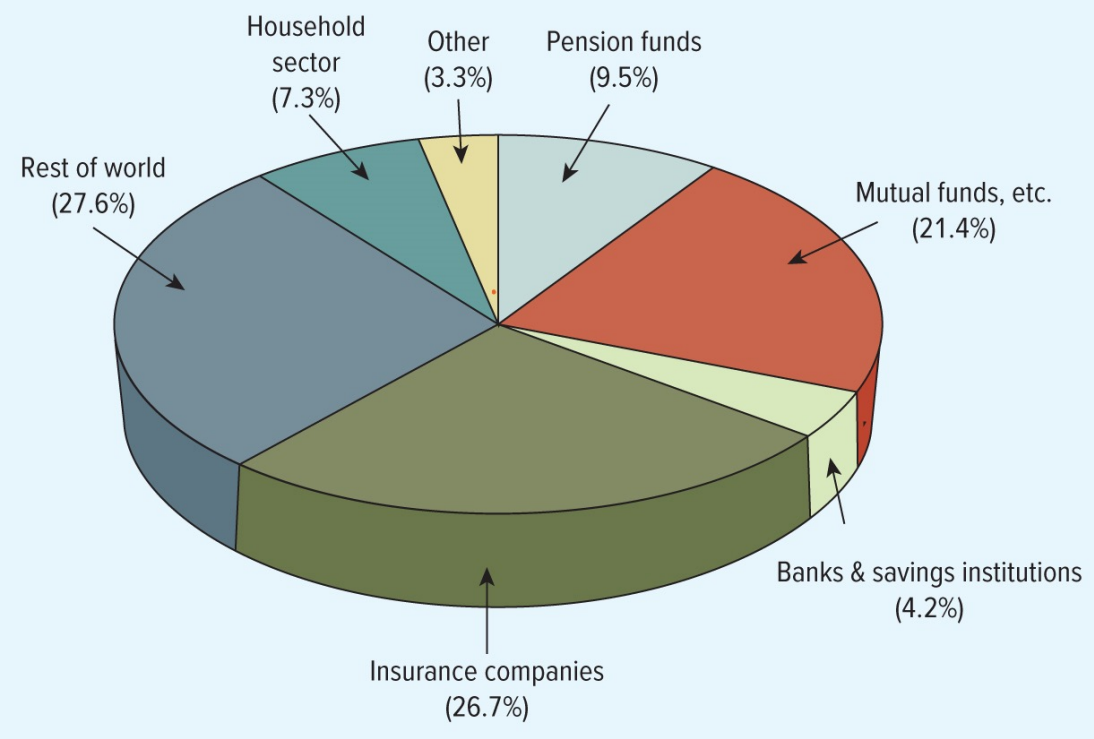
1) The higher is the YTM, the lower is the price of a bond.
2) Liquidity premium is the additional compensation used to encourage investors to invest in short-term, i.e., in more liquid, bonds.

A) Only statement I is correct
B) Only statement II is correct
C) Both statements are correct
D) Both statements are false

Do not forget:
Liquidity premium is offered to compensate the risk that might be generated by the **lack of** liquidity.

Now, such a situation is more likely to occur if my investment is for a longer term(!)

Financial intermediaries are the biggest **debtholders** in the United States, i.e., ***lenders*** of corporations (December 2020)



Debt is a **prior claim** on cash-flows

- **Bonds** (or notes) are traded on financial markets
- **Loans** are issued by banks directly

As a company, you decide:

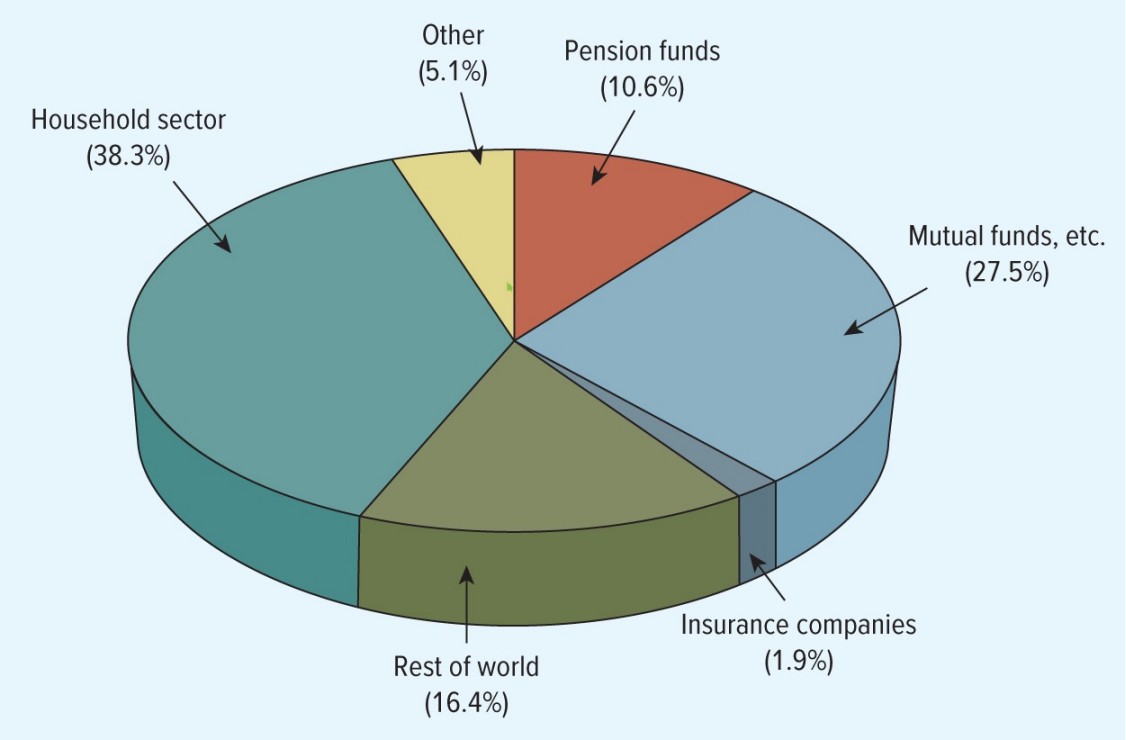
1: Borrowing short-term or long-term?

- Bank loan versus bond issuance

2: Fixed or *floating* (variable) interest rate?

- Risk-apetite? Hurdle rate you offer?

Financial intermediaries are the biggest **stockholders** in the United States, i.e., ***owners*** of corporations (December 2020)



Ownership: Cash-flow rights and control rights are concentrated

- As soon as company borrows money, cash-flow and control rights get separatred

Cash-flow rights

- Privilege for lenders
- **Residual for stock holders**

Right to receive dividends, IF dividends are paid

Digest the terminology: Stocks and stock market

Equity Book Value

- Net worth of the firm according to the balance sheet; **backward-looking**/ historical measure

Market Value

- Share (current) price when traded on the stock exchange; PV of all the future cash flows, indicates the market expectations on the firm; **forward-looking**

P/E Ratio

- Price per share divided by earnings per share; the most common measure of share value as investors compare against similar companies in the same industry; **expectations in the context of realized profit**

Important: Pay attention to the rates!

- Remember that there are always two sides to every transaction
- Just like in the case of bonds the yield to maturity is the return to the bondholder (investor) and it is also the cost of debt financing to the firm that is issuing the bond
- The ***Expected Return of Equity Investors*** *is also known as* **THE COST OF (Equity) CAPITAL** *to the firm raising funds*

Calculating the (realized) Return from an Investment

$$\text{Cash Return} = \text{Ending Price} + \text{Cash Distribution (Dividend)} - \text{Beginning Price}$$

Calculating the (realized) **Rate of** Return

$$\text{return} = r = \frac{\text{DIV}_1 + P_1 - P_0}{P_0}$$

$$\text{Rate of Return} = \frac{\text{Cash Return}}{\text{Beginning Price}} = \frac{\text{Ending Price} + \text{Cash Distribution (Dividend)} - \text{Beginning Price}}{\text{Beginning Price}}$$

Realized == we work with historical data, we know! **Expected ==** We use past evidence to predict the future!

Talking again about Opportunity Cost of Capital

It is the expected return on **identically risky investments** in the market. It is an alternative investment opportunity that we will give up if we decide to invest elsewhere.

Let us set up the scene:

You may **invest $100,000 today** in a fast-food business. The market shows that depending on the state of the economy, you may get one of three possible cash payoffs in 1 year:

Economy	Slump	Normal	Boom
Payoff	$80,000	$110,000	$140,000

What would be your **expected payoff**, in the context of these three scenarios?

Talking again about Opportunity Cost of Capital

You may **invest $100,000 today** in a fast-food business.
The market shows that depending on the state of the economy, you may get one of three possible cash payoffs in 1 year:

Economy	Slump	Normal	Boom
Payoff	$80,000	$110,000	$140,000

$$\text{Expected payoff} = C_1 = \frac{\$80{,}000 + \$110{,}000 + \$140{,}000}{3} = \$110{,}000$$

$$\text{Rate of Return} = (\$110{,}000 - \$100{,}000) / \$100{,}000 = 0.10 = 10\%$$

Opportunity cost of capital: identically risky investments in the stock market?

To determine the Opportunity Cost of Capital (OCC) we need to look for an identically risky investment in the stock market. So instead of developing our own fast food business we could invest in McDonald's.

Let us use these two signals to **predict** for future **expectations:**

Why do we want to know it? If we develop our own fast food business we give up the opportunity to invest in McDonald's.

How do we "predict" or expectations? Rate of return – based on historical evidence!

Question:

What is McDonalds close price of 8 November, 2025 (P_1) and of 7 November 2024 (P_0)?

Introducing Yahoo Finance: A tool to have a quick view on data. Fill the XXX out and let me know!

XXX USD (P_1) and XXX (P_0)

Opportunity cost of capital: What shall we do, open a restaurant or invest?

$$\text{Expected return} = r = \frac{\text{DIV}_1 + P_1 - P_0}{P_0} \quad , \text{DIV} = 0$$

So, our own fast food business is expected to generate a rate of return of 10%

Question: What is the **rate of return** you can expect from investing to McDonalds?

Again: XXXX USD (P_1) and XXXX (P_0)

(XXX USD - XXX USD) / XXX USD =

What should we do?

Now, pure mathematics would imply to go for the stocks, as the rate is a bit higher.
Nevertheless, owning your business implies growing opportunities, and Principle2 dictates!

Dividend payment is not a must. Firms can reinvest.

If a firm elects to pay a lower dividend today, this implies that a firm reinvest, boosting therefore its operation.

We therefore distinguish between:

- Payout Ratio = **Fraction (proportion) of earnings per share paid out as dividends**

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

- Plowback Ratio = **Fraction (proportion) of earnings per share retained by the firm**; ***Also called the reinvestment rate.***

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

Payout Ratio and Plowback Ratio needs to add up to 1

Whatever funds the company is not payout out as dividends,

it will reinvest back into the business

Plowback Ratio = 1 – Payout Ratio

Plowback Ratio + Payout Ratio = 1

Recall from previous lecture:
Valuing common stock using cash-flow assessment cont'd

$$\text{Return on Equity} = \text{ROE} = \frac{\text{EPS}}{\text{Book Value per Share}}$$

- EPS stands for **Earnings per Share**, it is how much income the company generated per one share of stock
- Book Value (or equity!)* per Share is how much (net) capital **was** invested per one share of stock

The ROE tells me how much income the company made based on how much capital they invested, the return generated given the amount invested, backward looking measure.

* Pay attention: Book Value per Share or Book Equity per Share refer to the same concept; often used interchangeably!

Long-term Growth Rate depends on a firm's dividend policy

1) Return on Equity = ROE $= \frac{Earnings\ Per\ Share\ (EPS)}{Book\ Value\ per\ Share}$ tells how much income the company made based on how much capital they invested, the return generated given the amount invested per share

2) Plowback Ratio $= \frac{Earnings\ per\ Share\ (EPS) - Dividend}{Earnings\ per\ Share\ (EPS)} = \frac{Amount\ Reinvested}{Earnings\ per\ Share}$ tells the reinvestment rate

Long-term growth can be derived from applying the *return on equity* to the percentage of earnings plowed back into operations.

In other words, long-term growth is the function of

- how successful the company is in generating profits, and
- the amount of money the company invest back to the business

g = return on equity X plowback ratio

Growth rate causes stock prices go up and down

$$\text{Price} = P_0 = \frac{\text{DIV}_1}{r - g}$$

g: Dividend growth rate is a *function of* the rate of return the firm is expected to earn on the reinvested earnings (**ROE**), and how much of the firm's earnings are **reinvested** (i.e. plowed back into operations).

g = return on equity × plowback ratio = ROE * (1 – dividend-payout (aka payout) ratio)

r: The investor's required rate of return is determined by two key factors:

1. The level of interest rates in the economy (recall: *opportunity cost of capital*);
2. The risk of the firm's stock in the ***context of the market*** **(!)** (foreword for β)

Stay tuned for our discussions on Capital Asset Pricing model and on portfolio management

Valuing common stocks continued

Consider the followings:

BUGG Pty. forecasts paying an $8.33 dividend next year, which represents 100% of its earnings, i.e. Earnings per Share = $8.33. This will provide investors with a 15% expected return. (= **Case1**)

- **Alternatively,** Bugg can decide to plow back 40% of the earnings at the firm's current return on equity of 25%. (= **Case2**)

Question: How would such management decisions influence the stock price?

List what we know / what we have:

We are dealing with two cases, thus looking for two stock prices:

- Case 1: Company has 100% payout ratio
- Case 2: Company has 40% plowback ratio

Valuing common stocks continued – Case1

Consider the followings:

BUGG Pty. forecasts paying an $8.33 dividend next year, which represents 100% of its earnings, i.e. Earnings per Share = $8.33. This will provide investors with a 15% expected return.

Case 1: Company has 100% payout ratio, meaning that there is no reinvestment, thus it is expected that **neither** dividends nor earnings will grow. Therefore, Div_1 = EPS_1 and the company is expected to pay out this dividend indefinitely

- As a result, we find easily the price of the stock by valuing of the company without any growth using the perpetuity formula:

$$Perpetuity = P_0 = \frac{Div_1}{r} or \frac{EPS_1}{r} \longrightarrow P_{0,Case_1} = \frac{\$8.33}{0.15} = \mathbf{\$55.53}$$

Valuing common stocks continued – Case2

Consider the followings:

BUGG Pty. forecasts paying an $8.33 dividend next year, which represents 100% of its earnings, i.e. Earnings per Share = $8.33. This will provide investors with a 15% expected return.

Case 2: Company reinvests 40% of earnings back into the business at the firm's current return on equity of 25%. The company, ergo the **dividends** are ***expected to grow***. It also implies that the company has 60% payout ratio and 40% plowback ratio (remember that the two ratios add up to one or 100%).

If dividends are expected to grow, we immediately associate the price-seeking problem with

$$Price\ of\ Stock_0 = \frac{Div_1}{r - g}$$

We know the expected return, we know the dividend, but what is with ***g***? It is expected to grow, so what?

Valuing common stocks continued – Case2

Consider the followings:

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If dividends are expected to grow, we can derive the long-term growth rate in dividends, that is:

g = return on equity X plowback ratio → $g = 25\% \; x \; 40\% = 0.25 \; x \; 0.40 = 0.10 = 10\%$

For Case2, the price would therefore be:

$$P_{0,Case_2} = \frac{\$5.00}{0.15 - 0.10} = \$\mathbf{100}$$

Summing up the results: Case1 – Case2

Case 1: Present Value of Company Without Growth

$$P_0 = \frac{\$8.33}{0.15} = \$55.56$$

Case 2: Present Value of Company With Growth

$$P_0 = \frac{\$5.00}{0.15 - 0.10} = \$100$$

The **difference** between these two numbers is called the **Present Value of Growth Opportunities** (PVGO), which explains, how much the growth prospects of the business contributes to the value of the stock today.

PVGO = $100.00 – $55.56 = $44.44

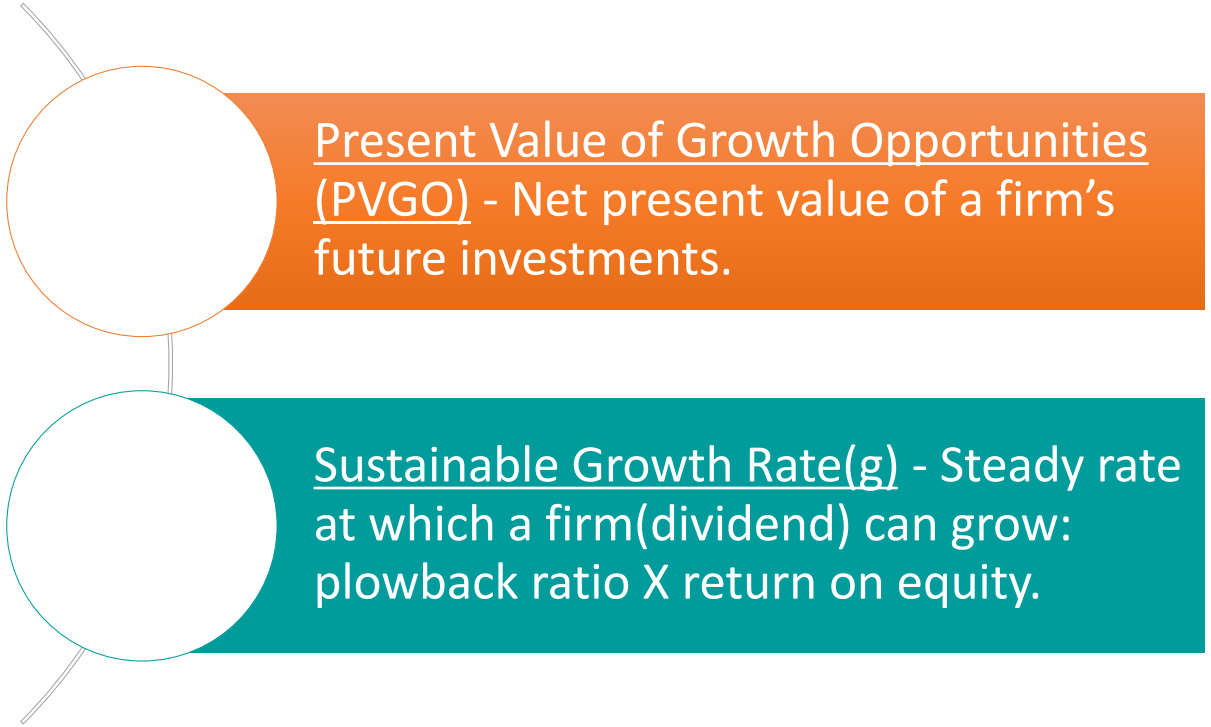
Just to repeat:
Three fundamental steps to value a common stock

- **Cash-flow assessment**: Estimate the *amount* and *timing* of future cash flows of the *stock* is expected to provide (see e.g. DDM)

- **Risk assessment**: Evaluate the riskiness of future dividends, and determine the rate of return an investor would expect to receive from a comparable investment (recall: opportunity cost vs hurdle rate) (see e.g. price derived from expected return)

- **Present value equals price**: Calculate the PV of expected future cash-flows (recall DCF) using the stock's rate of return (see e.g. Gordon Growth Model)

Value of a common stock is very much **depending on the reinvestment** decisions and dividend-payout policies
Again: both are firm-dependent measures



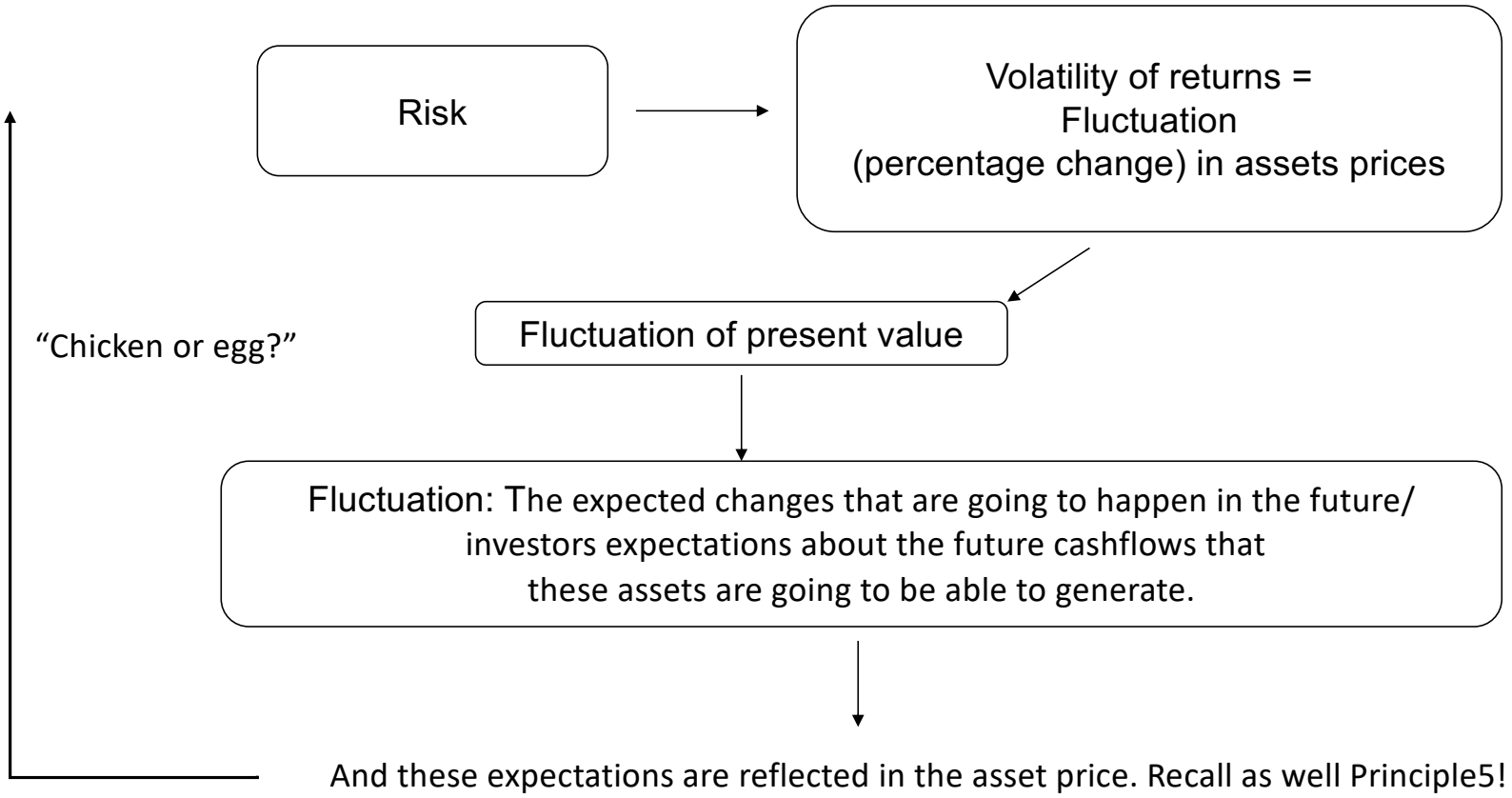
Why aren’t we happy yet?

Our reference for valuing a common stock and for calculating the expected return of a stock price is the **company** itself (i.e. firm’s cash-flow, value, risk)

- We are thus pretty myopic: Companies are part of a financial system!

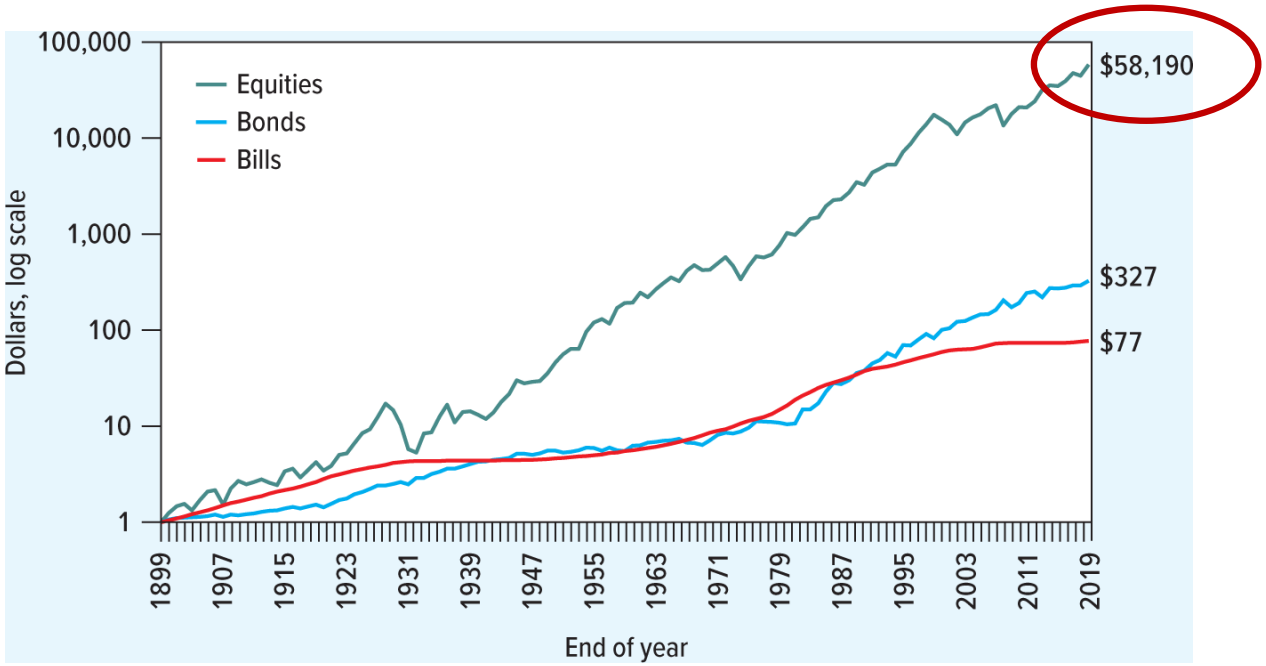
We would need an absolute, market-driven measure as well for risk assessment!

Why do we always talk about risk and return (or, in other words: reward) together?



How an investment of $1 at the end of 1899 would be by the end of 2020

…assuming reinvestment of all dividend and interest payments

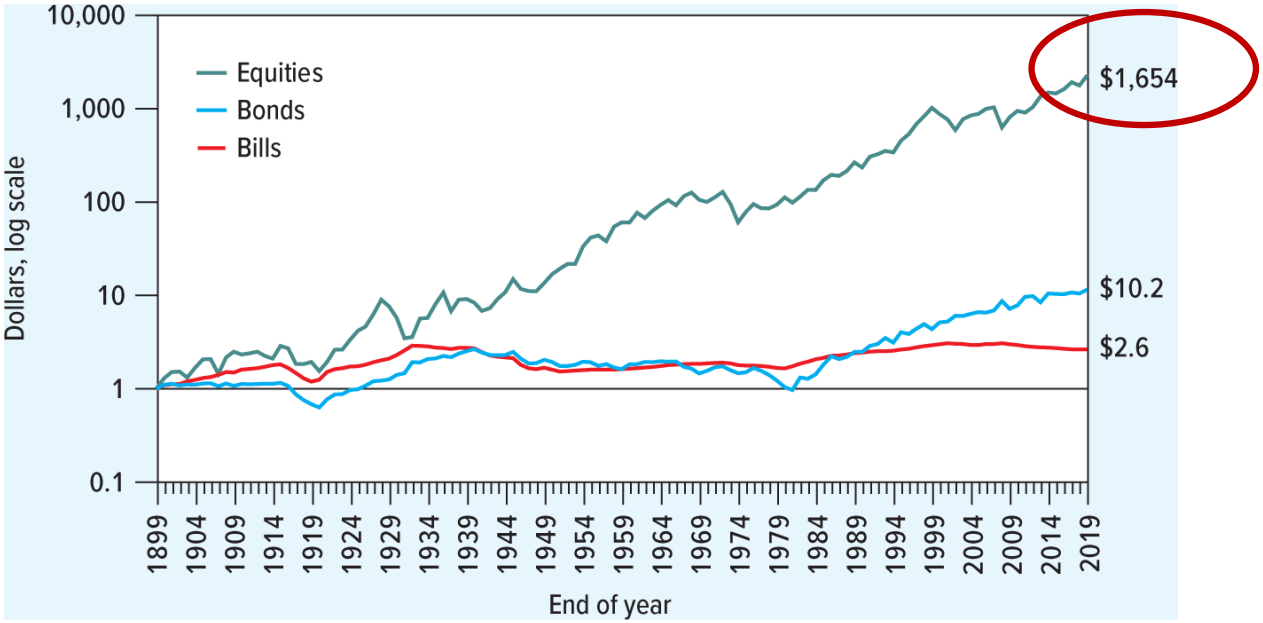


Source: E. Dimson, P. R. Marsh, and M. Staunton, **Triumph of the Optimists: 101 Years of Global Investment Returns** (Princeton, NJ: Princeton University Press, 2002), with updates provided by the authors.

Historical performance/ rate of return of the main types of the assets classes from an investor's point of view.

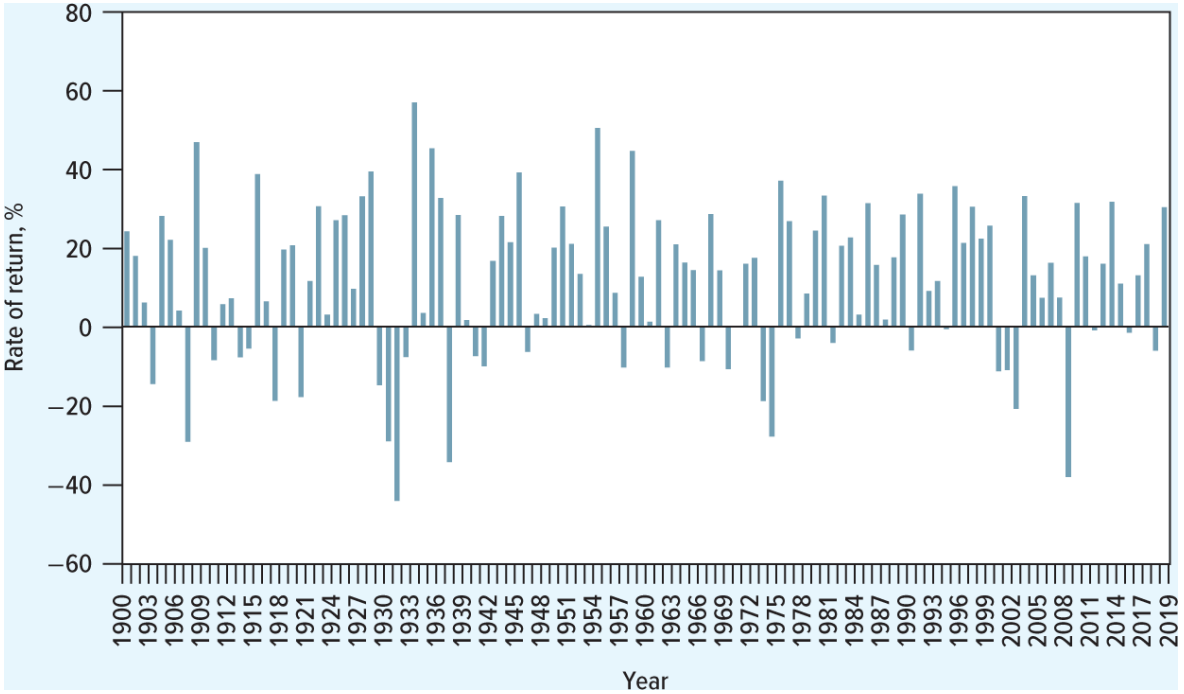
How an investment of $1 at the end of 1899 would be by the end of 2020 by **real terms,** including inflation

…assuming reinvestment of all dividend and interest payments



Source: E. Dimson, P. R. Marsh, and M. Staunton, **Triumph of the Optimists: 101 Years of Global Investment Returns** (Princeton, NJ: Princeton University Press, 2002), with updates provided by the authors.

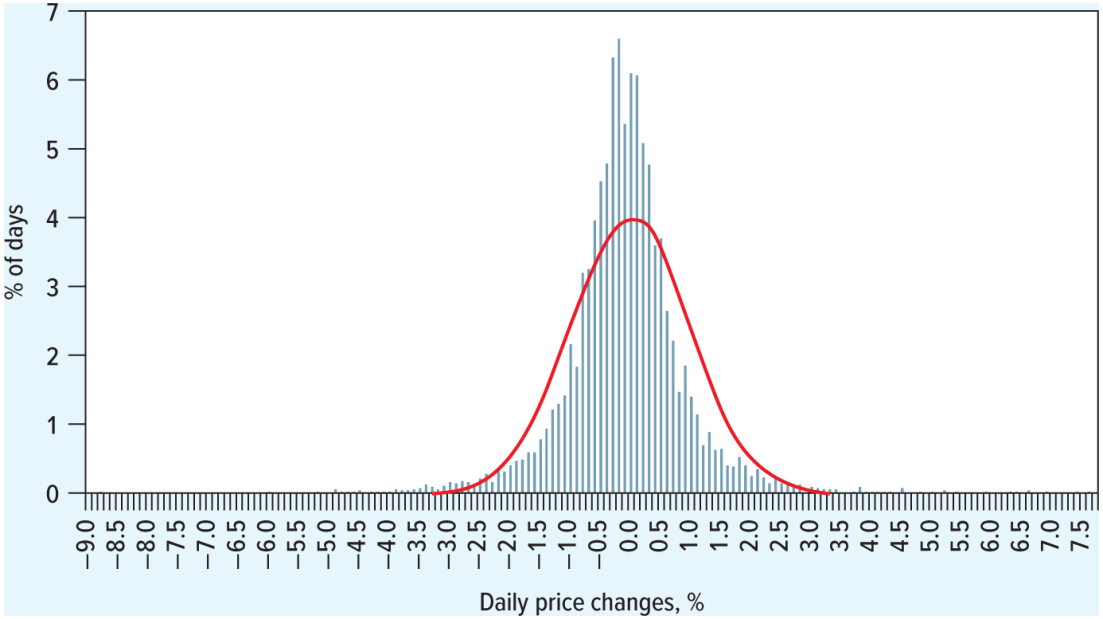
Stock market is an agora of volatile investment opportunities as returns indicate



Source: E. Dimson, P. R. Marsh, and M. Staunton, **Triumph of the Optimists: 101 Years of Global Investment Returns** (Princeton, NJ: Princeton University Press, 2002), with updates provided by the authors.

What would statistics tell us about prices?
See daily price changes e.g. for IBM, following a normal distribution

Price changes versus normal distribution 1997–2019.



So, apparently, transaction data “behaves” – please do the “Flip your Coin” experiment!

Measuring risk: Let us do a game

Coin Toss Game – you start with £100, 2 coins, for each head that comes up we top our starting balance with 20%; and for each tail that comes up we reduce our starting balance by 10%

We have four possible outcomes:

- Head + head: We gain (+20%+20%) = 40% (1 in 4 chance or 1/4=0.25)
- Head + tail: We gain (+20%-10%) = 10%
- Tail + head: We get (-10%+20%) = 10%

(2 in 4 chance or 2/4=0.5)

- Tail + tail: We get (-10%-10%) = - 20% (1 in 4 chance or 1/4=0.25)

Thus, the expected percentual return rate is (40%+10%+10%-20%) / 4 = **10%**

Statistics and probabilities allow us to **quantify** risk
Say hello to variance (σ^2) and standard deviation (σ)

(A) **Percent Rate of Return** (Actual) $\hat{r}$	**(B)** **Deviation from Expected Rate of Return** (Actual – Expected) $\widehat{(\boldsymbol{r} - \mathbf{r})}$	**(C)** **Squared Deviation** (Column B Squared) $\widehat{(\boldsymbol{r} - \mathbf{r})^2}$	**(D)** **Probability** of Given Outcome	**(E)** **Probability x Squared Deviation (Column C x Column D)**
+40	40-10=30	$30^2 = 900$	0.25	900 x 0.25 =225
+10	10-10=0	$0^2 = 0$	0.5	0 x 0.5=0
-20	-20-10=-30	$(-30)^2 = 900$	0.25	900 x 0.25 = 225
		Variance = expected value of $\widehat{(\boldsymbol{r} - \mathbf{r})^2} = \mathbf{450}$ Standard deviation = $\sqrt{variance} = \sqrt{450} = 21\%$		

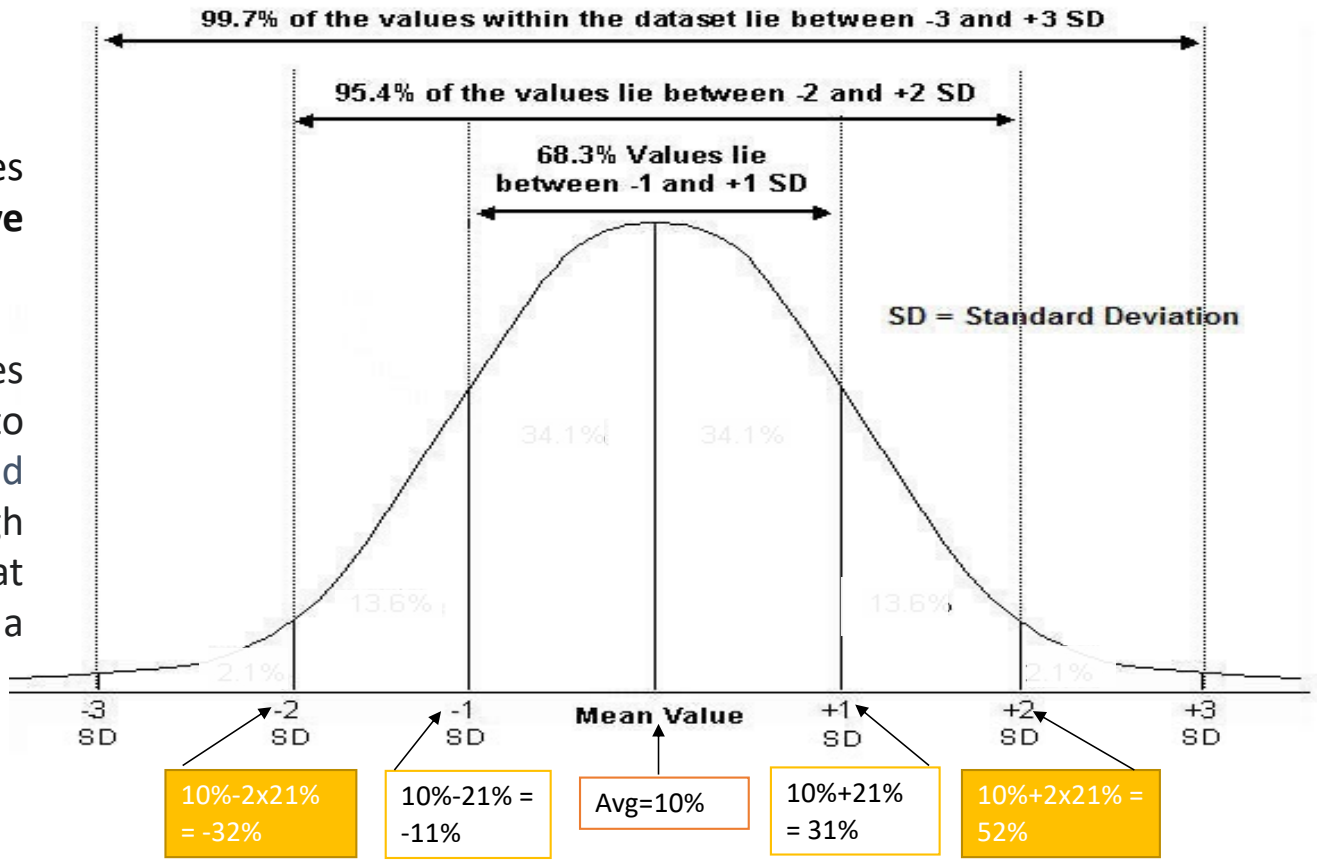
SD is expressed in percentage term, which is as same as the unit of rate of return.

Standard deviation is our main measure of our bell-shaped curve

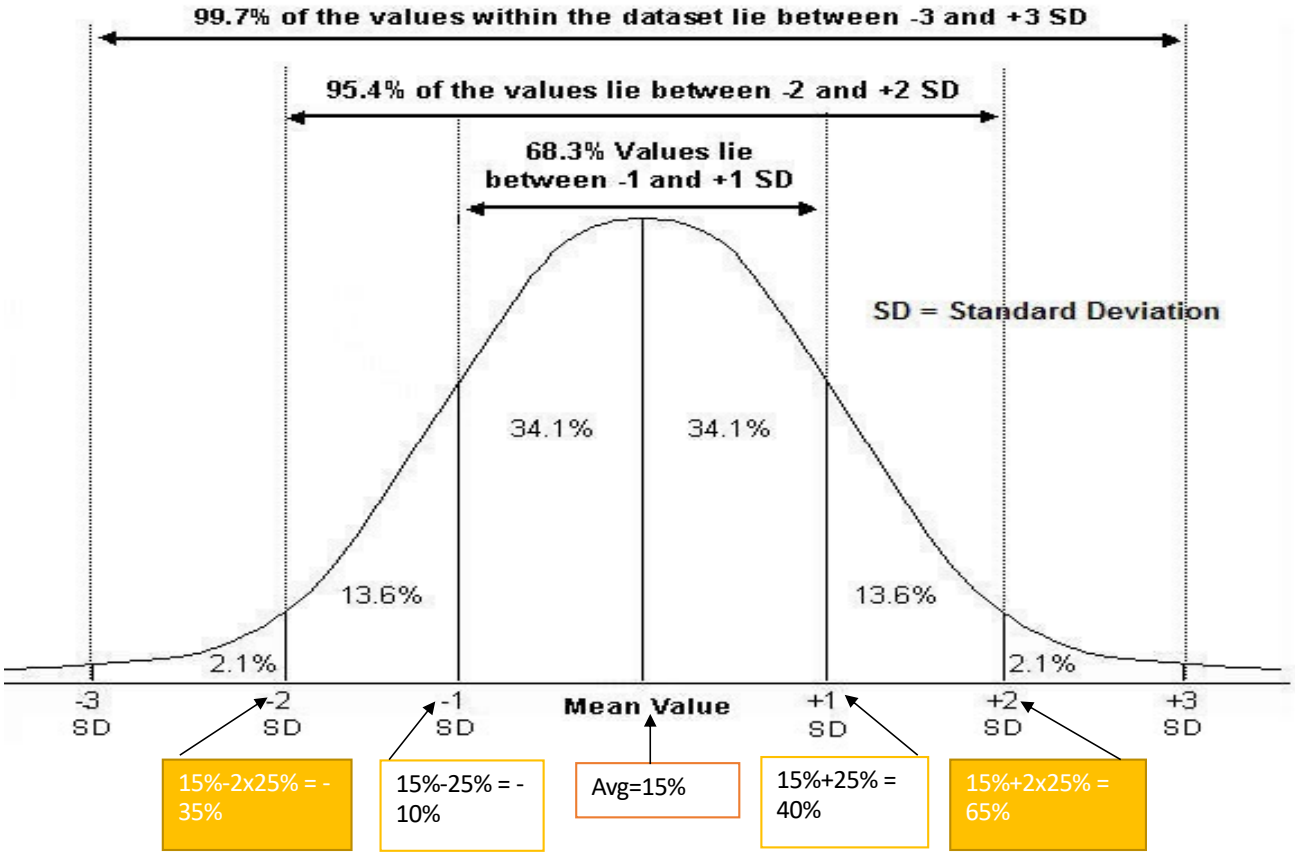
“Visualizing risk”: Exp(r), i.e. “mean value” is 10% and SD is 21%

Standard Deviation (SD) measures the **dispersion of a dataset relative to its mean.**

A low standard deviation indicates that the values tend to be close to the mean (also called the expected value) of the set, while a high standard deviation indicates that the values are spread out over a wider range.

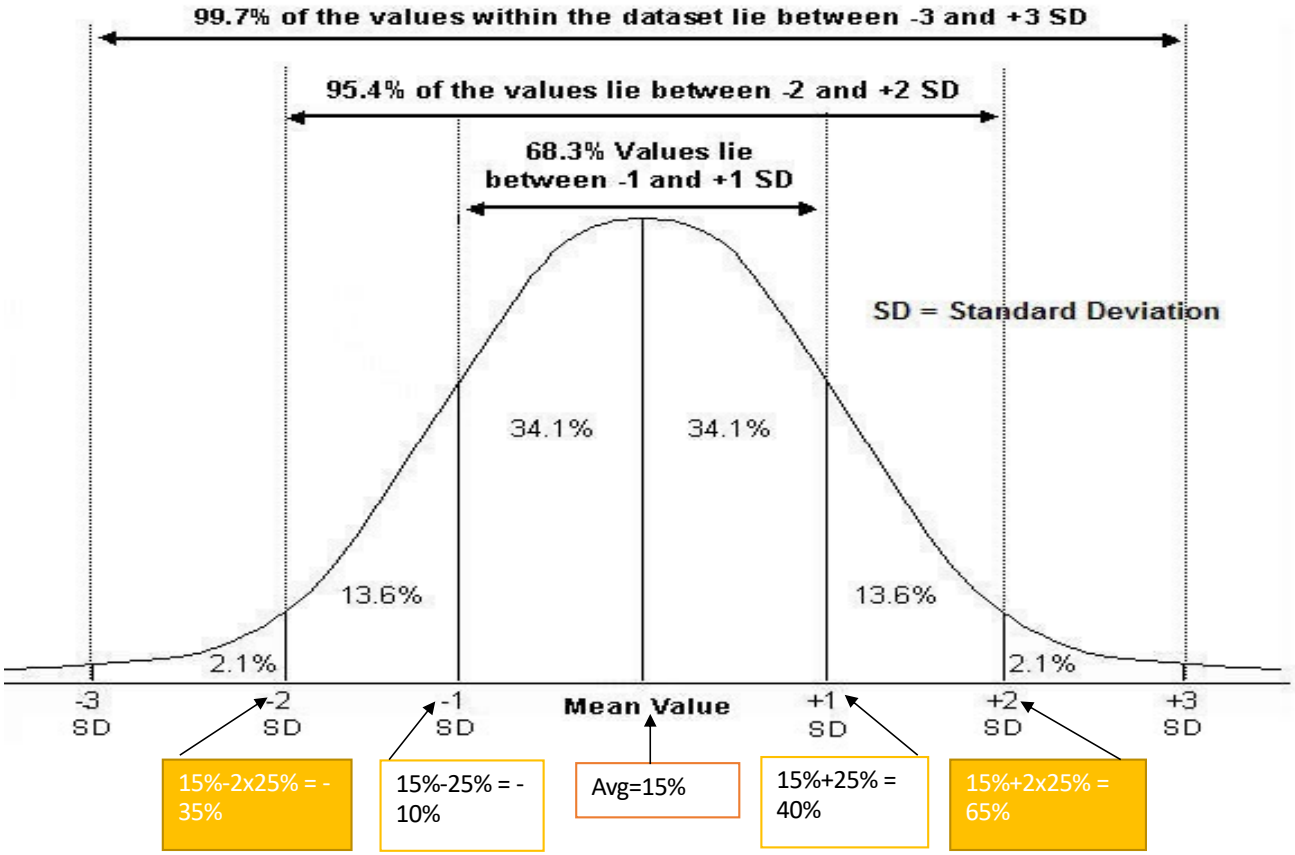


The normal distribution provides a good approximation of how the returns on assets behave



- ✓ Suppose that we have a dataset of 10 stocks
- ✓ We observe the monthly returns on these stocks over the last 10 months
- ✓ We have a total dataset of 10 stocks x 10 months = 100 observations
- ✓ The average return on these stocks over the 10 month period is 15%
- ✓ The standard deviation of these returns is 25%

In this example below shows that on average we expect 15% return with the standard deviation of 25%



If I randomly select a given monthly stock return out of my sample of 100 stock returns:

- ✓ I can be 68.3% certain that the value of my randomly selected data point is within 1 standard deviation range around the mean (average)

- i.e. my randomly selected data point is 68.3% likely to be within (15%-25% to 15%+25%) and hence its value is 68.3% likely to be between (-10% and +40%)

Digest the term: Measuring risk

Variance (σ^2)

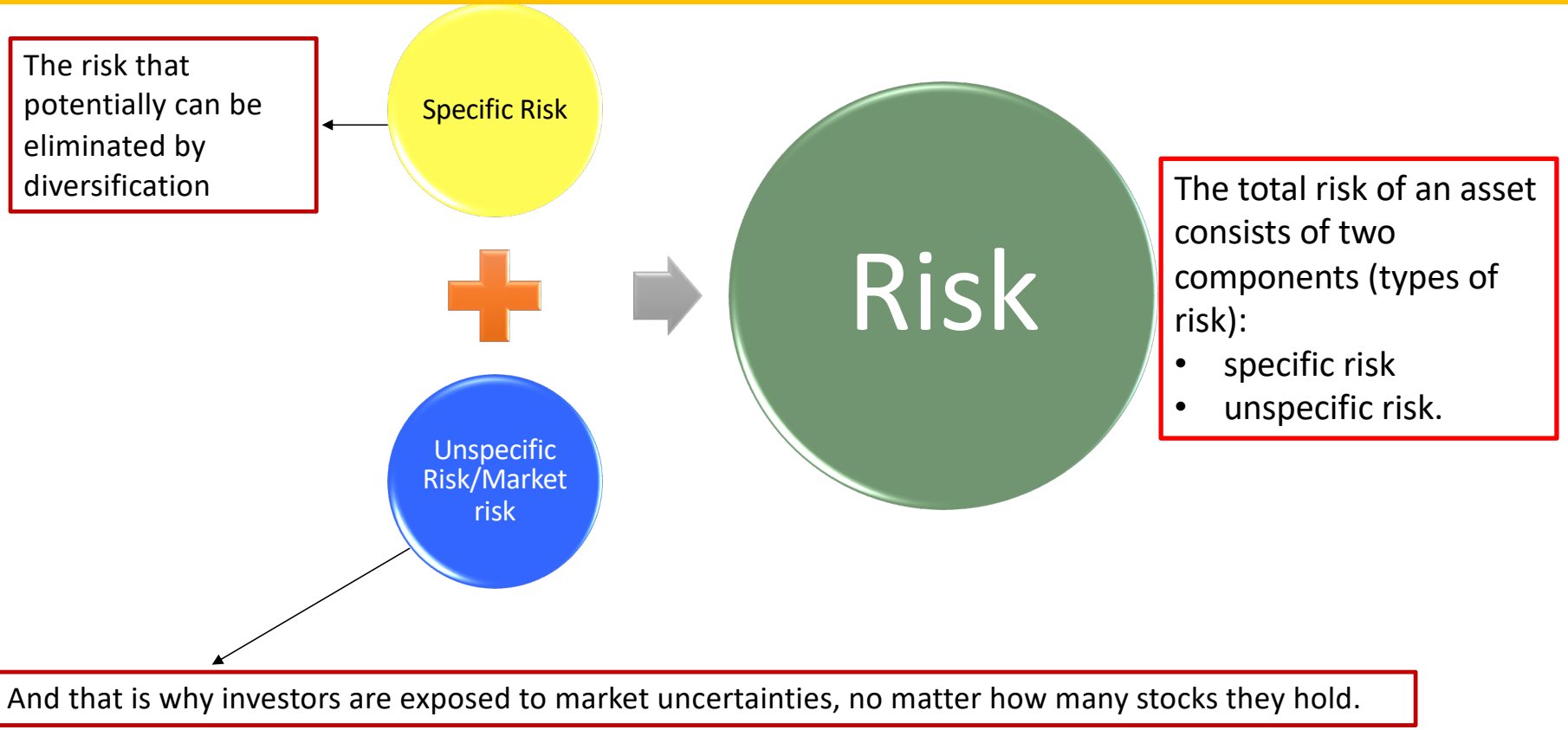
Average value of squared deviations from mean, i.e. in our context of risk and return characteristics of stocks, from the expected return.

Standard Deviation (σ)

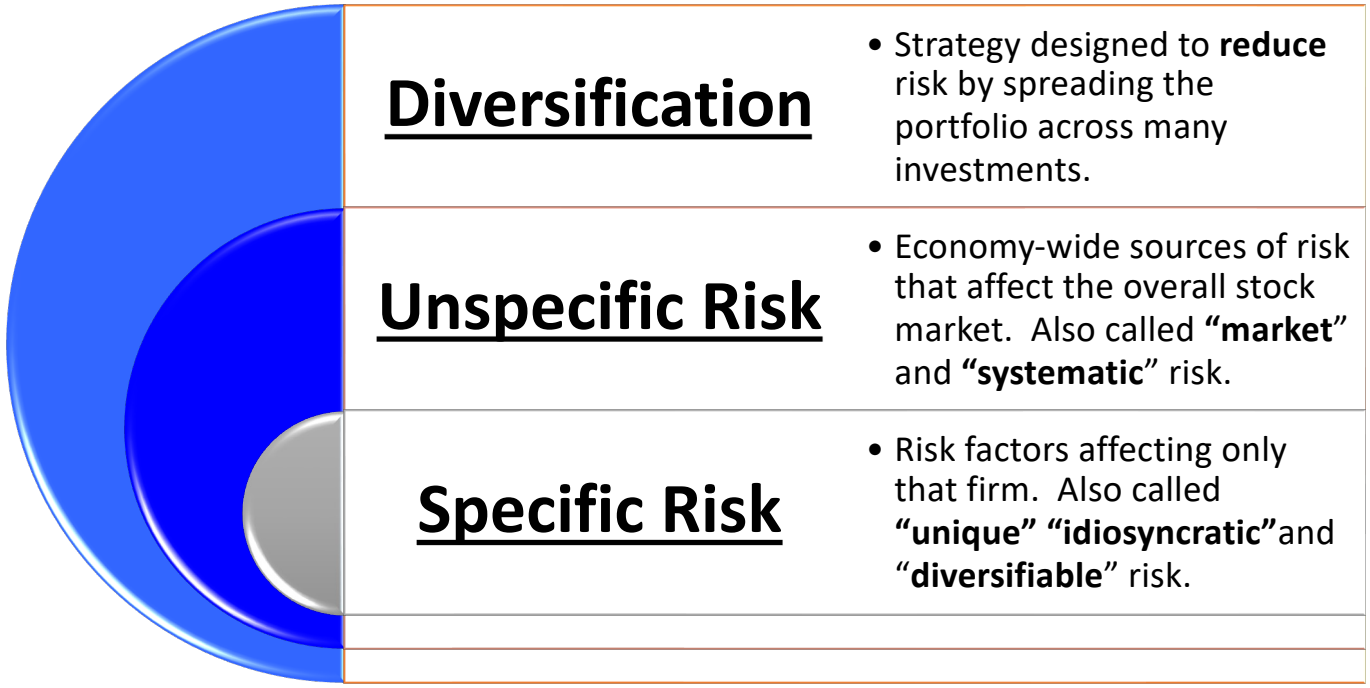
The square-root of variance. It tells us the dispersion of a dataset relative to its mean.

We also use these measures to address volatility – stay tuned!

Conceptualizing "Risk" for Finance



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



To compile a portfolio of common stocks…

Portfolio: Grouping of financial assets (e.g. stocks, bonds)

- Can also consist of non-publicly tradable securities, i.e. private investments

… you opt to **diversify** your assets, i.e. you **combine** investments whose **returns do not move together (? What is this?)**, thus, are not perfectly positively correlated.

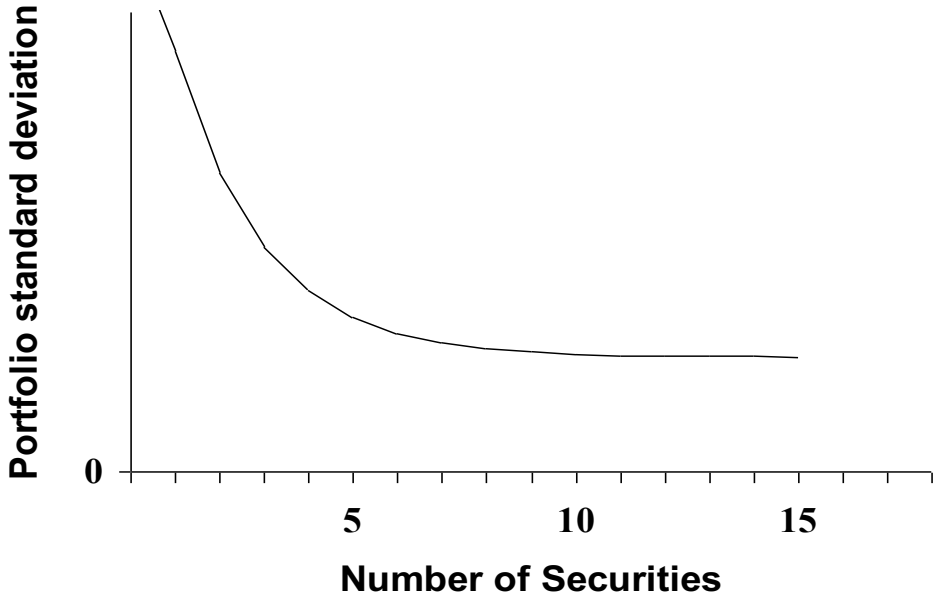
Tool to **lower the risk** of your portfolio without lowering it's ***expected rate*** of return

- There is some risk that diversification cannot eliminate

"Moving together" **(? What is this?)** is measured by using the **correlation coefficient:**

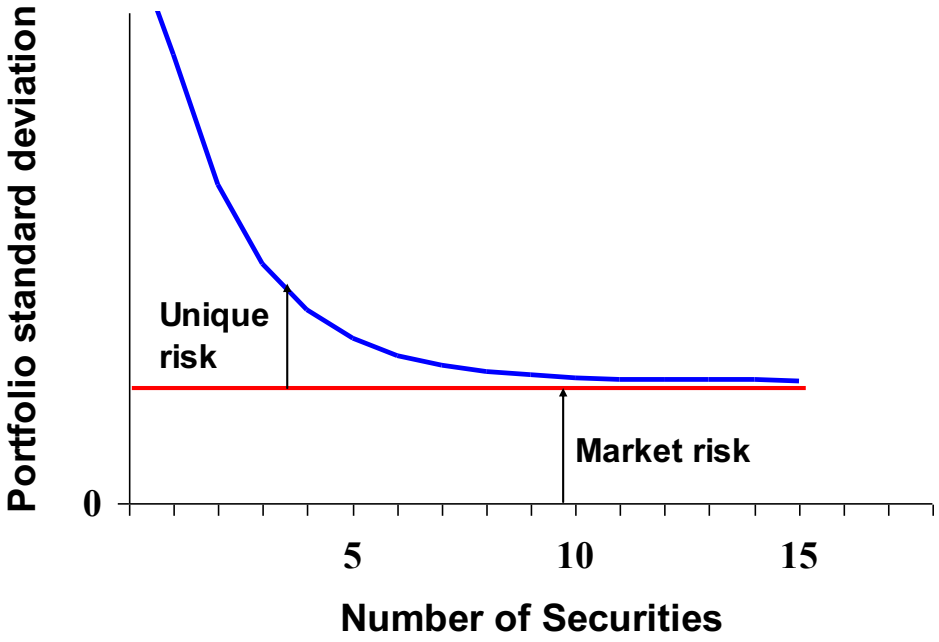
- A value ranging between -1 (perfectly uncorrelated) and 1 (perfectly correlated)

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



The more companies that we have, the broader the spread of specific risk. And so it's much less likely that if anything bad happens to one of those companies, it's going to have a significant impact on our business.

Diversification reduces variability: reducing exposure to specific 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.

Diversification helps maintaining *expected* return
So, how to calculate, in fact, **portfolio return**, to start with?

The portfolio's rate of return is a **weighted average of the rates** of return of the assets included in the portfolio.

- The weights that are used represent the **proportion** (or percentage) that is invested in each asset.

$$\text{Rate of Return} = P(r) = w_1 \times r_1 + w_2 \times r_2 + \ \ldots + wn \times rn$$

For two assets in the portfolio:

$$\begin{aligned} \text{Portfolio rate of return} = {} & \text{fraction of portfolio in first asset} \times \text{rate of return on first asset} \\ & + \text{fraction of portfolio in second asset} \times \text{rate of return on second asset} \end{aligned}$$

Diversification helps maintaining expected return
How to calculate then the ***expected*** return of an investment?

Expected return is what the investor expects to earn from an investment in the future, based on the calculated rate of return. It **operates with possibilities**!

- It is the **weighted** average of the **possible returns**, where the weights are determined by the probability that it occurs.

$$\begin{matrix}\text{Expected Rate}\\ \text{of Return}\\ [E(r)]\end{matrix} = \left(\begin{matrix}\text{Rate of}\\ \text{Return 1}\\ (r_1)\end{matrix} \times \begin{matrix}\text{Probability}\\ \text{of Return 1}\\ (Pb_1)\end{matrix}\right) + \left(\begin{matrix}\text{Rate of}\\ \text{Return 2}\\ (r_2)\end{matrix} \times \begin{matrix}\text{Probability}\\ \text{of Return 2}\\ (Pb_2)\end{matrix}\right) + \cdots + \left(\begin{matrix}\text{Rate of}\\ \text{Return } n\\ (Pb_n)\end{matrix} \times \begin{matrix}\text{Probability}\\ \text{of Return } n\\ (Pb_n)\end{matrix}\right)$$

We use weights and apply return expectations of a given asset in the portfolio to address expectations on portfolio return

Suppose you invest 60% of your portfolio in Wal-Mart (food) and 40% in IBM (business service). The expected dollar return on your Wal-Mart stock is 10% and on IBM is 15%.

The expected return on **your portfolio** is:

$$\text{Rate of Return} = P(r) = w_1 \times r_1 + w_2 \times r_2 + \ \ldots + wn \times rn$$

w tell the fraction of the asset in the portfolio
as ***r*** stands for expected return in this example, we calculate the expected return of the portfolio

$$\text{Expected Return} = (.60 \times 10) + (.40 \times 15) = 12\%$$

We did a lot in this lecture, most importantly

Financial system; introduction to financial markets

- Equities continued
- Long-term growth as the function of dividend policy
- Payout versus plawback ratio, and what they represent
- Risk: Conceptualizing risk, measuring risk
- Introduction to diversification, to portfolio return