WELCOME TO
Introduction to Finance
for
MSc Financial Technology and Innovation

Lecture 2

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Your knowledge-asset so far:

- What is Finance? What is money?
- Principles of Finance
  - Money has a time value
  - There is a risk-return trade-off
  - Cash flows are the source of value
- Axioms
  - Corporations always need money
  - Economic reciprocity
  - We take decisions today, thus we calculate with today's value as the reference
- Capital structuring (investments, financial assets) versus capital budgeting (real assets)
- PV and FV

Digest the terms: Present and Future Value

Present Value:

The value today of a future cash flow

Future Value:

The amount to which an investment will grow after earning interest

What is the study of Finance?

Finance refers to all money-related **transactions** and to the **performance** of **decisions** that consumers, businesses, and governments make.

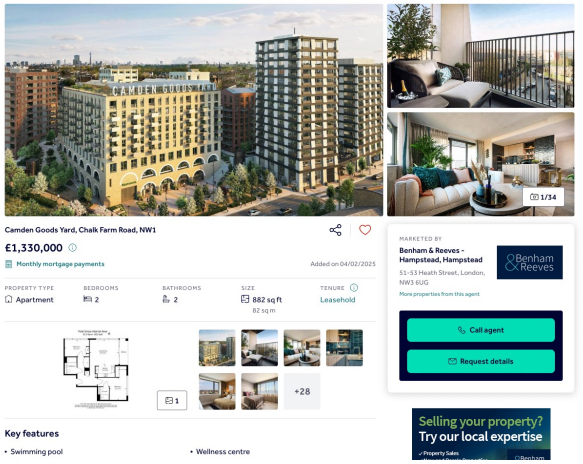
Two key ideas: Knowledge exists to **“price in”** the consequences of decisions, and that decisions shall lead to **maximize** financial performance.

And so: Why would you study Finance?

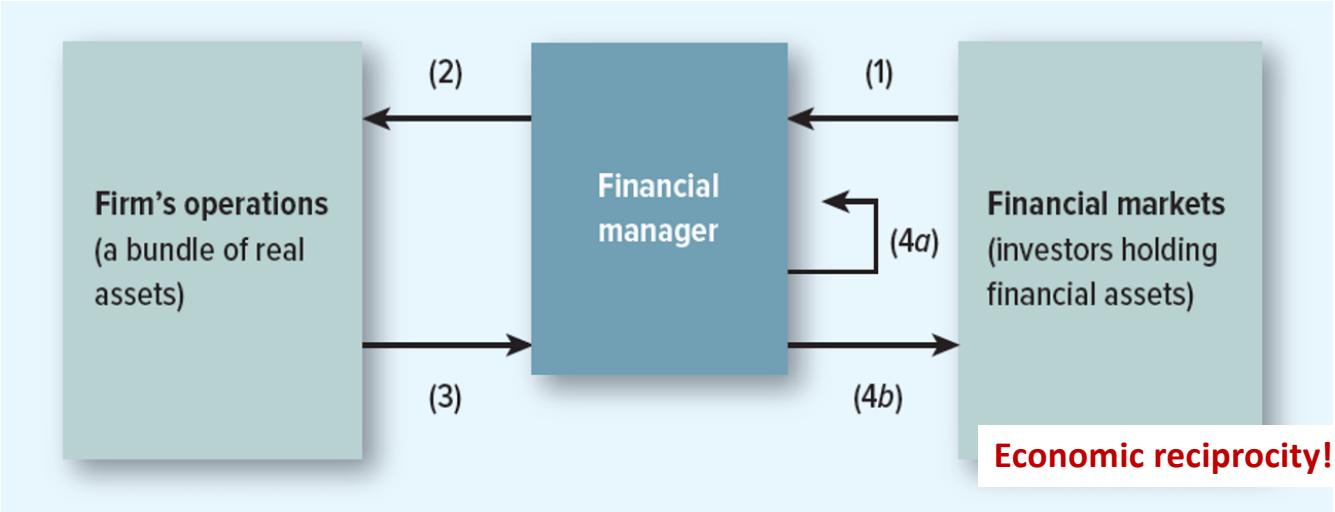
You want to **close the gap** between **price and value**, so

to be able to make solid financial decisions and thus,

to maximize financial performance.



A financial manager takes capital structure and capital budgeting decisions at a **specific time point**!



… but transactions can happen at different time points

… and so the performance, ie the outcome of our decisions might differ over time. Thus:

Axiom3 calls for a common reference: The **present** time point (see as well 1st Principle)

D-Tour: Is money finite or infinite?

- Central banks are public institutions, monitoring and managing fiat money
- If a central bank wants to increase the amount of money in circulation (e.g. to boost economic activity), the central bank can
  - print money directly (**Q: helicopter money? Do you happen to recall a recent example?**)
  - *buy government bonds (i.e. fixed-income securities) in the market, putting money into the marketplace, thus effectively into the hands of the public* – STAY TUNED!

"As strange as it sounds, the central bank simply creates the money and transfers it to those selling the securities; i.e. financial assets that can be traded and represents an investment" (textbook)

D-Tour #2: What is digital money?

Any **token** that represents a currency, money, or money-like asset that is primarily managed, stored or exchanged on digital computer systems, especially over the internet

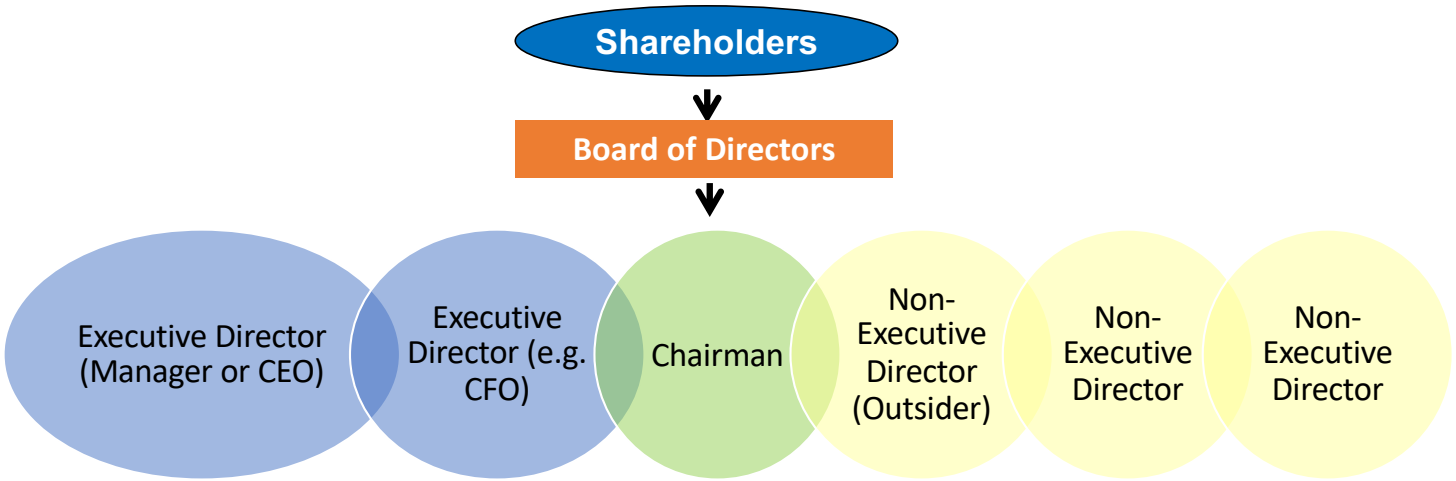
- Origins: 1990s Dot-com bubble

- Cryptocurrency: sub-type of digital money, relies on cryptography to chain together digital signatures of asset transfers, on peer-to-peer networking and thus on decentralization

The rise of cryptocurrencies enabled us to **think differently** about the ***structure*** of **traditional financial systems**, but the **study of Finance**, thus, "*Finance refers to all money-related transactions and to the performance of decisions that consumers, businesses, and governments make (see 1st lecture)*" **is the same**

What are corporations?

- Legal entity, owned by shareholders
- Can make contracts, carry on business, borrow, lend, sue, and be sued
- Corporations can be public or private
- A large public corporation may have hundreds of thousands of shareholders

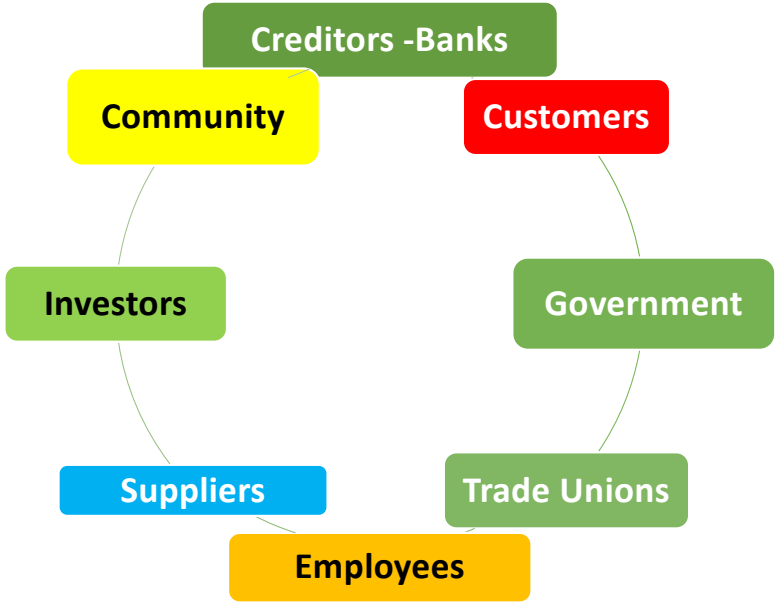


Corporation

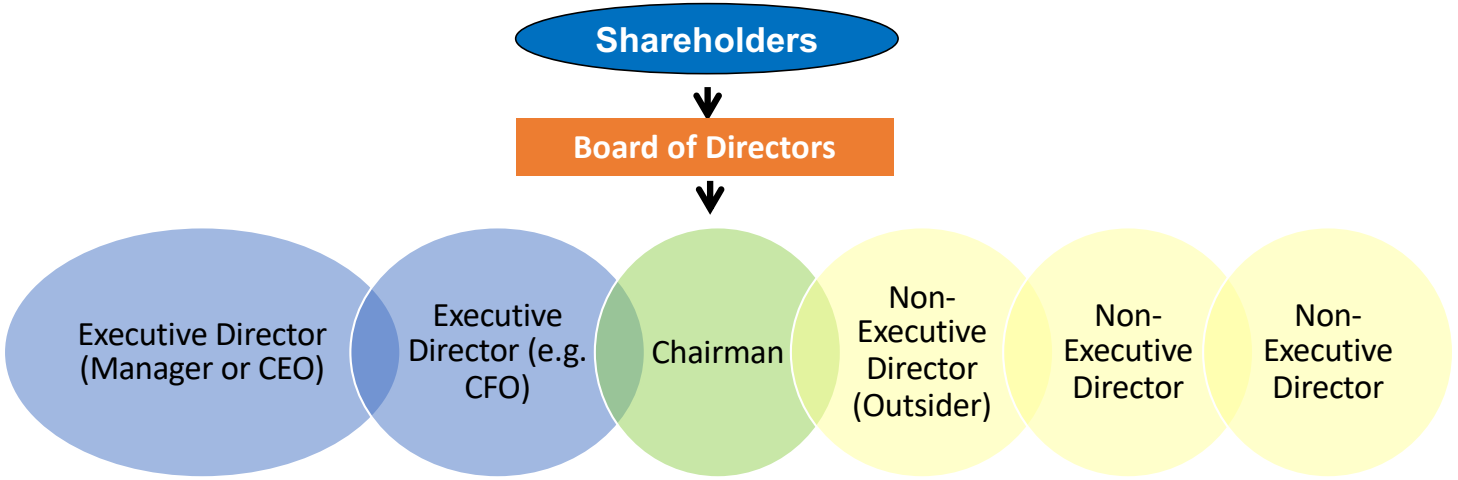
- Separation of ownership and management
- Limited liability
- Profits taxed at corporate and individual level
- Life potentially unlimited
- Financing not limited by owners' resources

Shareholders respond to incentives they are given in the corporate world.

Shareholders are stakeholders, but not all stakeholders are shareholders.



Can incentives differ per individual in a corporate world? Can the *response* to incentives differ?



Axiom 1: Corporations always need money → individuals, too!

Everyone acts in their own best interest: Profit maximization!

Agency problems represent the conflicts of interest

Shareholders (principals) VS Managers (agents)

1) **Everyone acts in their own best interest**

- Shareholders wants the manager to make decisions which will increase the share value
- Managers respond to incentives, and may act in their own interests: expand the business and increase their salaries, which may not necessarily increase share value

2) **Differences** in the information available to company insiders and outsiders ("Asymmetric Information") creates agency issues: Managers have more information!

Agency Theory discusses, analyzes how to make sure that the agents act in the best interest of the principals

- Making sure that the interests of the principals and the agents are ***aligned***
- ***Additional note****: Not only the interests but the impact of individual responses, too!*

Corporate governance to mitigate agency problems

It is a toolkit for the management and the BoD to deal more effectively with the challenges

- To ensures to have appropriate decision-making processes and controls in place so that the **interests** of **all stakeholders** (shareholders, employees, suppliers, customers and the community) are **balanced**

Set of procedures make sure that a company is run in such a way that it achieves its objectives, while keeping stakeholders' confidence and trust

What is corporate governance?

"the system of rules, practices and processes by which companies are directed and controlled"

Cadbury Committee, 1992

- ✓ Corporate governance involves balancing the interests of a company's many stakeholders
- ✓ Corporate governance sets out the rules, controls, policies and resolutions to dictate corporate behaviour
- ✓ **A key responsibility of the Board of Directors is to ensure that the corporation is governed appropriately**
- ✓ Through customs, practice and laws, corporate governance is about the way the company is controlled and the accountability of those in control
- ✓ It includes the processes through which a company's objectives are set and pursued in the context of the social, regulatory and market environment

THE FIVE BASIC PRINCIPLES OF FINANCE CONTINUED

Principle 4: Individuals Respond to Incentives

… and that behavior is often costly

If the incentives are not properly aligned, managers may make decisions inconsistent to increasing shareholder value; leading to **agency costs**.

- Managers do not attempt to maximize firm value
- Shareholders incur costs to monitor managers and constrain their actions

Role of corporate governance is to **minimize** the costs

Shareholders monitor, but their power can be limited…

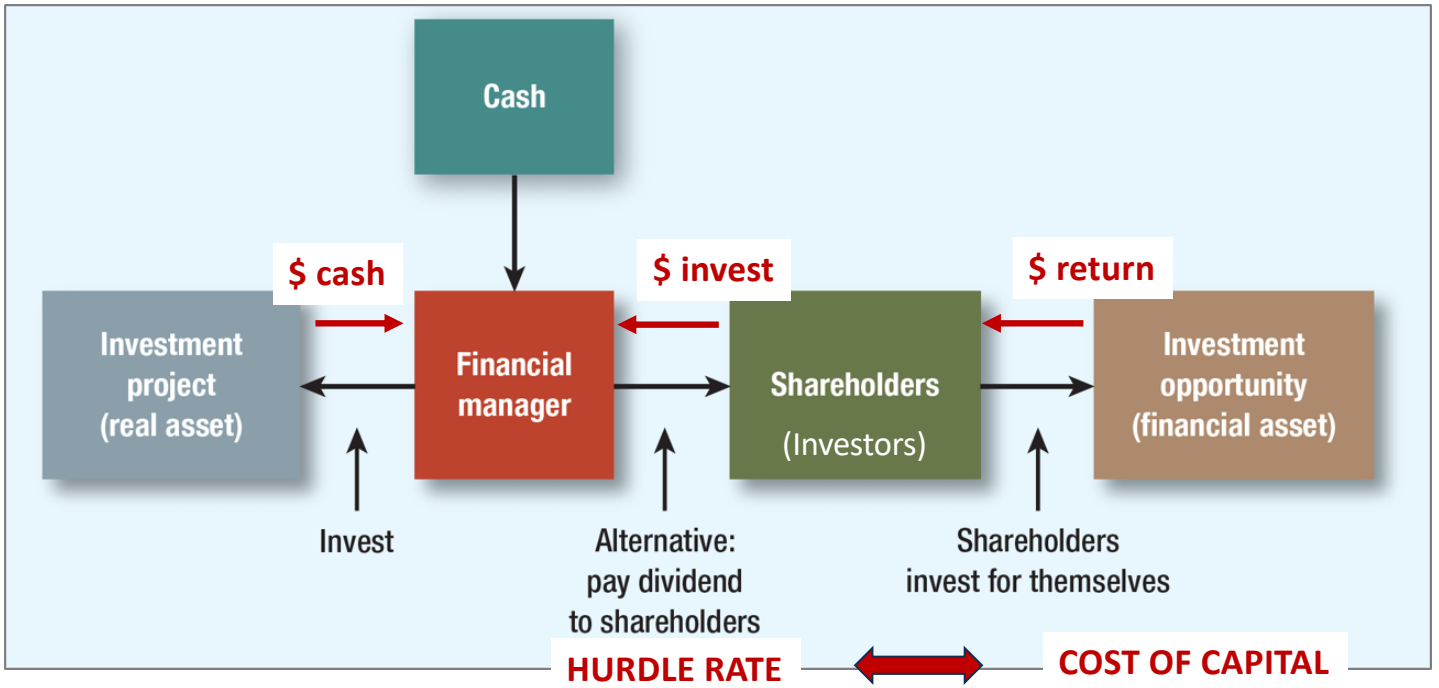
… and so, **additional devices, such as a healthy corporate governance help to control** corporations for **stakeholders**.

Stakeholders are:

- The board of directors
- The large shareholders (blockholders, these are institutions such as pension funds and insurance companies)
- auditors (objective, external control)
- creditors (control on cash inflow)
- Regulators: Compliance of rules and regulations of the financial market and system
- Regulators: Government to ensure e.g. the financial stability and sustainability of households

… And they **all respond to incentives**!

Principles 1,2,3 & 4 for corporations lead to: The investment trade-off of *investors*



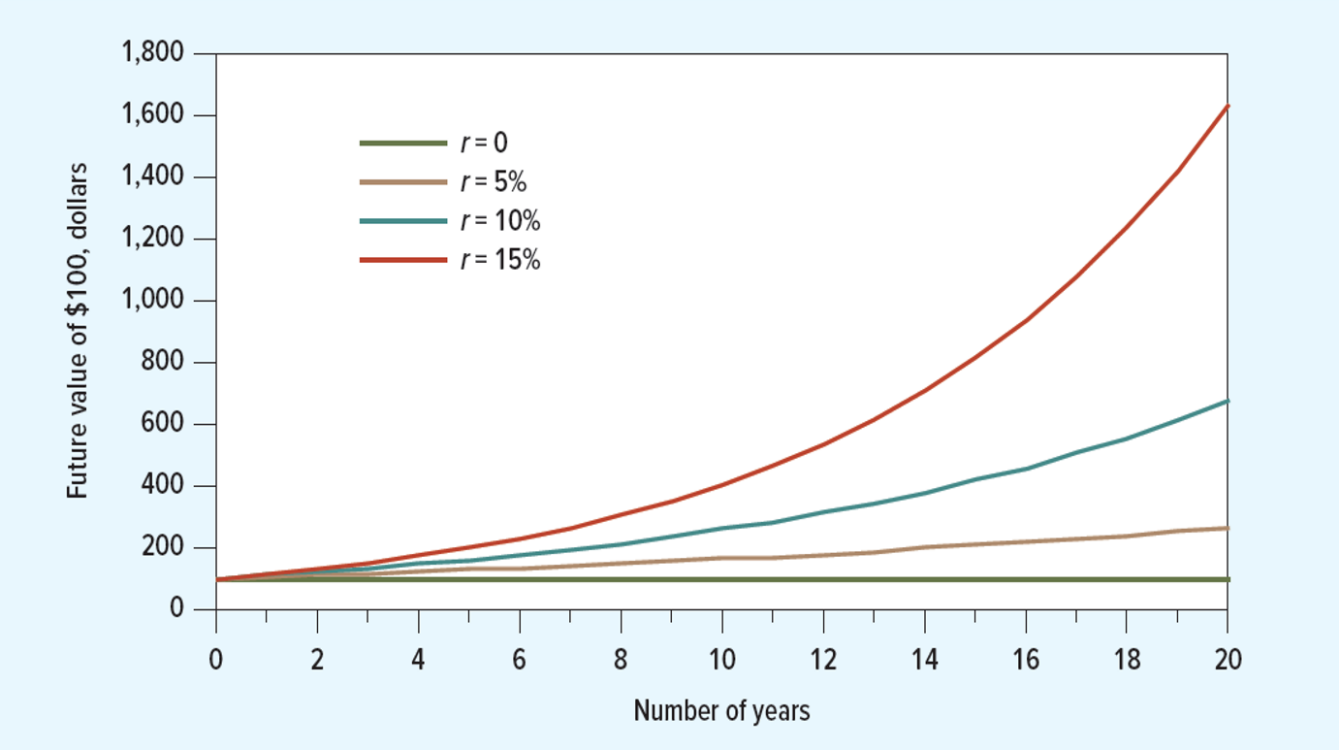
- **Hurdle rate**: Minimum acceptable rate of return on investment for shareholders
- Shall match **opportunity cost of capital**, which depends on the investment opportunities available in financial markets

If you are investing, you are after the Future Value (FV): Amount to which an investment will grow after earning **interest**

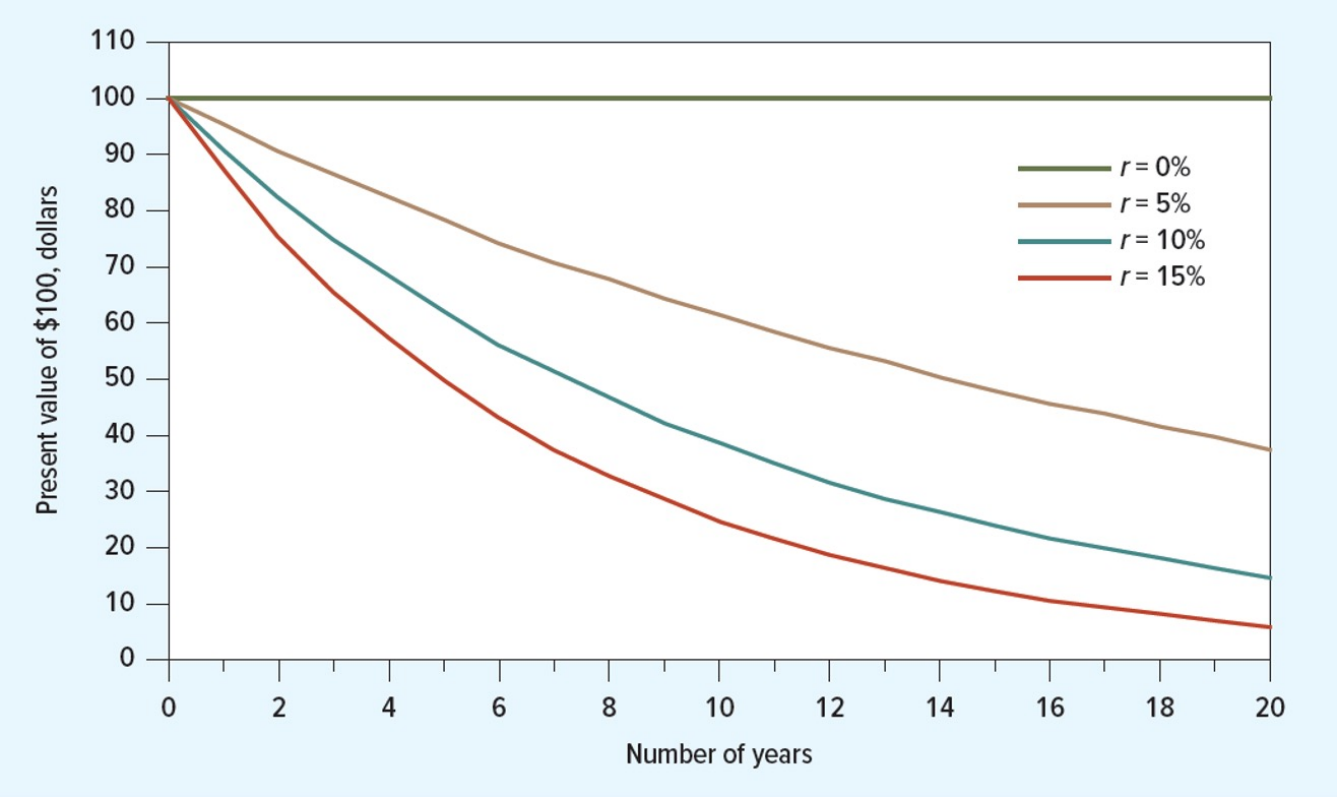
$$FV = C \times (1 + r)^t$$

Where

- C: capital, ie investment
- r: interest rate
- t: year
  (as well as nr of installments)



PV with discounting: the longer you have to wait for your money, the less it is worth today



Digest the term: Discount Factor for Present Value

Re-writing the PV formula leads to:

$$PV = \frac{C_t}{(1+r)^t} = C_t * \frac{1}{(1+r)^t}$$

Discount factor

- The rate r is the discount rate
- PV is the discounted value of the cash flow C_t
- The expression $1/(1+r)^t$ is called the discount factor
- The discount factor is the **present value** of one unit of currency ($, £, etc.) received in year t

CHECKPOINT: *Working with data*

How (why) to discount *future cash inflows* for today?

Your problem-solving model

Step 1: Picture the problem, *list what you know*

Step 2: Decide on the solution strategy, *list what you have*

Step 3: Apply the techniques and solve the problem

Step 4: Conclude, interpret results

Given two dollars, **one** received **a year** from now and the **other** one **two years** from now, **find** the one- and two-year discount factors. Assume $r_1 = 20\%$ and $r_2 = 7\%$.

1) **List what you know**:
   1) Y1: I receive my dollar back with 20% interest
   2) Y2: I receive my dollar back with 7% interest

2) **Solution strategy, what we have**:
   1) We just introduced the discount factor

   $C_t = 1$, $r_1 = 20\%$, $r_2 = 7\%$

$$PV = \frac{C_t}{(1+r)^t} = C_t * \frac{1}{(1+r)^t}$$

Given two dollars, **one** received **a year** from now and the **other** one **two years** from now, **find** the one- and two-year discount factors. Assume r_1 = 20% and r_2 = 7%.

$$DF_1 = \frac{1.00}{(1+0.20)^1} = 0.83$$

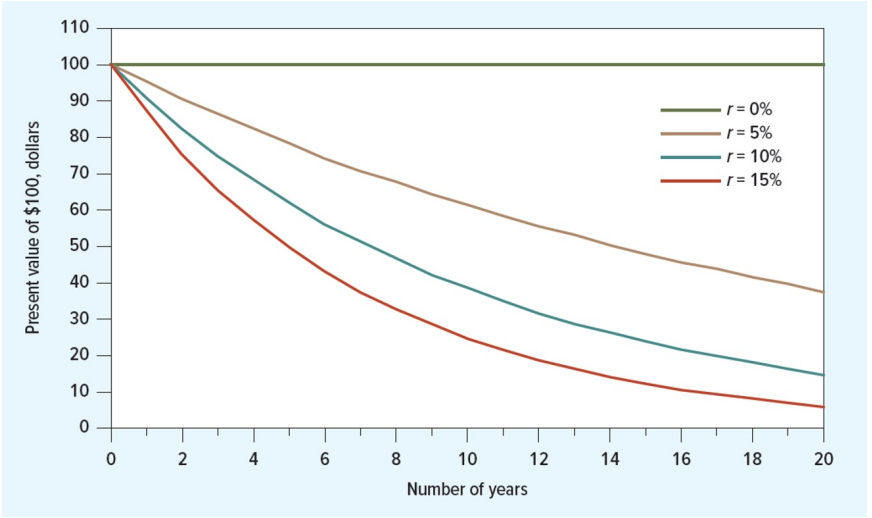
$$DF_2 = \frac{1.00}{(1+0.07)^2} = 0.87$$

3) Apply the techniques and solve the problem

$$PV = \frac{C_t}{(1+r)^t} = C_t * \frac{1}{(1+r)^t}$$

4) Conclude, interpret:

The discount factors are 0.83 and 0.87, respectively, showing the present value of the unit currency. The higher interest rate, i.e. r_1, explains the lower present value for a shorter time frame.



Which option would you chose today?

Your boss at the bank has said your **bonus of £1000** will be payable (get the cash) in **4 years** (with no conditions) or **you can get £600 today**. The 4-year interest rate is 9%.

Which should you take?

Assume you don't need the money now.

Step 1: Picture the problem, *list what you know*

Step 2: Decide on the solution strategy, *list what you have*

Step 3: Apply the techniques and solve the problem

Step 4: Conclude, interpret results

Your boss at the bank has said your **bonus of £1000** will be payable (get the cash) in **4 years** (with no conditions) or **you can get £600 today**. The 4-year interest rate is 9%.

Which should you take?
Assume you don't need the money now.

1) **List what you know**:
    1) Today 600 GBP or 1000 GBP in 4-year time
    2) Interest rate for the 4-year is 9%

2) **What we have**:
    1) PV, FV, the discount factor – **which one would you chose? PV? FV?**

Remember: This exercise has more solution strategies; in fact, both PV And FV can lead to the solution, as there is two time reference in the exercise (i.e. today, and in 4 years)

Your boss at the bank has said your **bonus of £1000** will be payable (get the cash) in **4 years** (with no conditions) or **you can get £600 today**. The 4-year interest rate is 9%.

Which should you take?
Assume you don't need the money now.

3) Apply the technique and solve the problem

$$PV = DF_4 * C_4$$

$$DF_4 = \frac{1}{(1+0.09)^4}$$

$$PV = \frac{C_t}{(1+r)^t}$$

$$DF_4 = 0.70843$$

4) Interpret the results

$$PV = 0.70843 * 1000$$

$$PV = £708.43$$

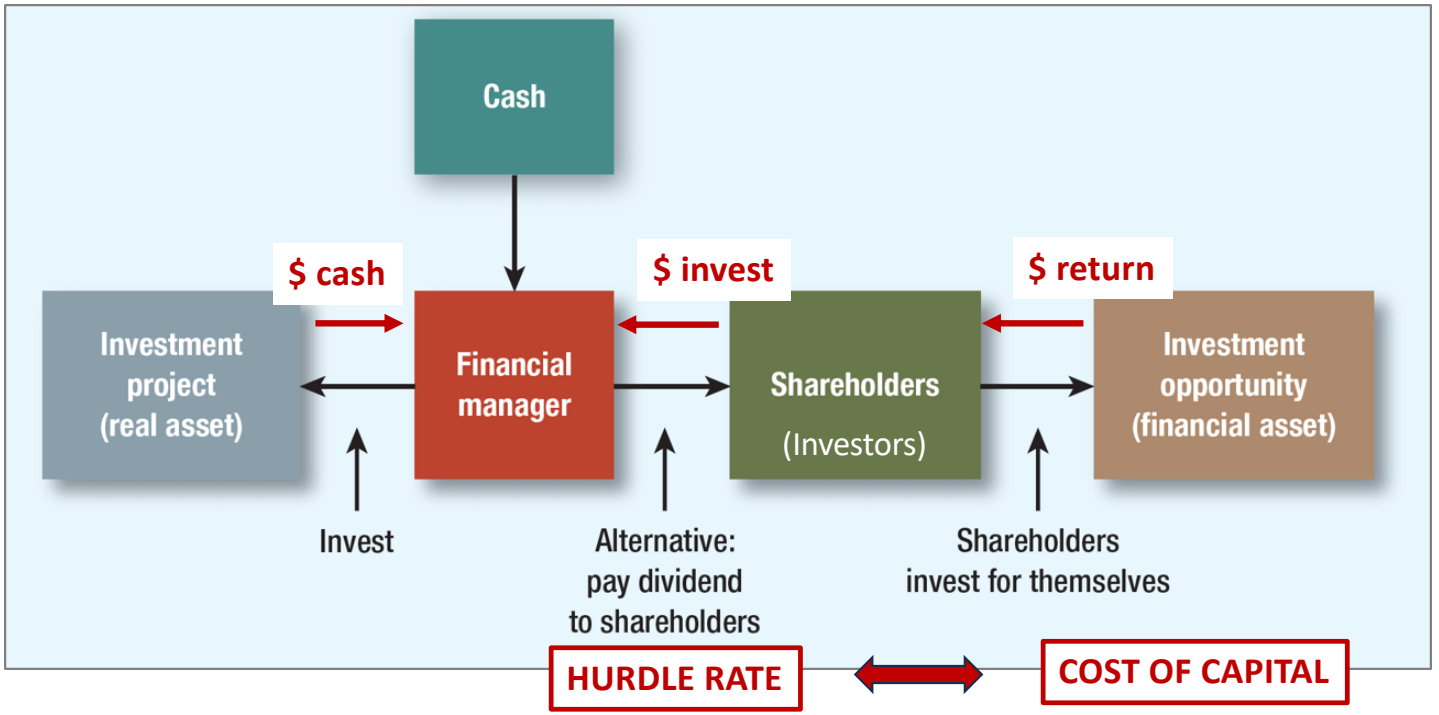
Discount Factors can be used to compute the present value of any cash flow.

Is There An Alternative Solution?

Of course, you could have as well applied the future value on the 600 GBP of today:

- What is £600 invested at 9% for 4 years? £600 * (1.09^4) = £846.95

So, to invest: Hurdle rate offered by a project shall compensate cost of capital offered by other investment opportunities



- **Hurdle rate**: Minimum acceptable rate of return on investment for shareholders
- Shall match **opportunity cost of capital**, which depends on the investment opportunities available in financial markets

CHECKPOINT: *Working with data*

Deciding on an investment opportunity

Shall we invest to a construction project or not?

Details of our investment:

$$\text{Cost of building} = C_0 = \$700,000$$

1st assumption: We can for sure finance it

$$\text{Sale price in Year 1} = C_1 = \$800,000$$

2nd assumption: We can for sure sell it

$$\text{Opportunity cost of capital} = 7\%$$

3rd assumption: Capital market offers a **return of 7%** to earn

List what you have: PV, FV – which one to use?
Cost ($700k), sale ($800k) in a year, 7% interest, and I need to decide today

PV it is: $PV = \frac{C_t}{(1+r)^t}$ as follows:

$$\text{PV} = \frac{C_1}{(1+r)} = \frac{\$800,000}{(1+0.07)} = \$747,664$$

If investment: $700.000, shall we proceed or not?

Valuing an investment opportunity: Go ahead if PV of payoff exceeds investment.

$$\text{NPV} = \$747,664 - \$700,000 \ = \$47,664$$

Digest the term: Net Present Value (NPV)

NPV = CASH FLOWS IN minus CASH FLOWS OUT

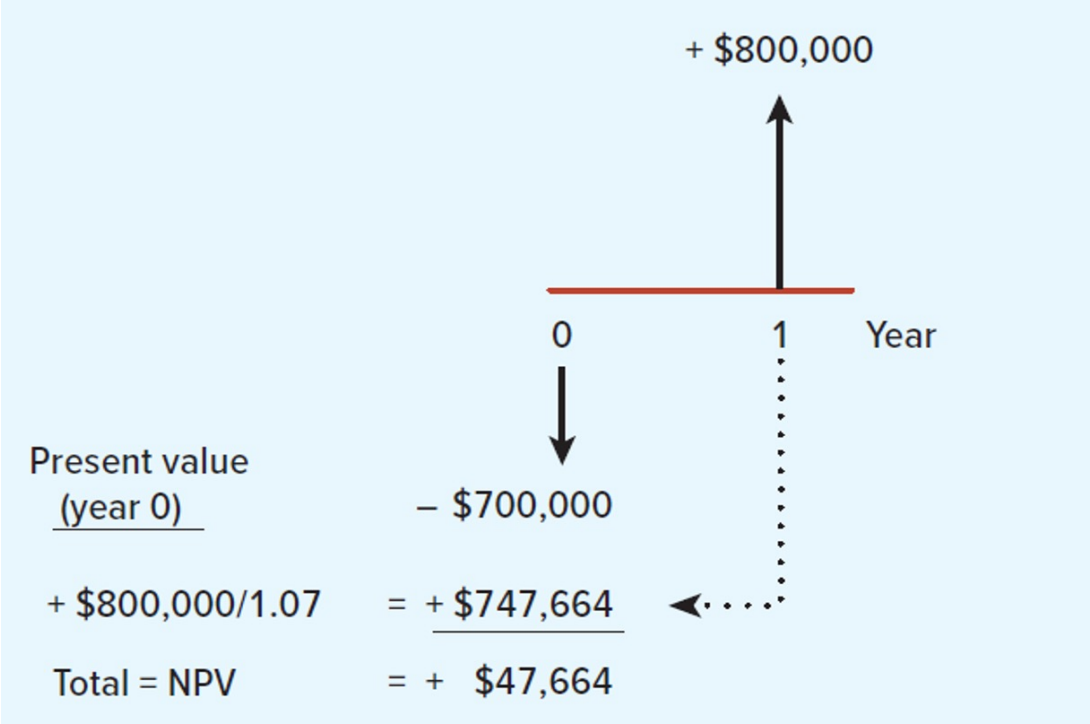
NPV = PV (receipts) – PV of Required Investments (expenditures)

If we assume that we will have one positive cash flow (receipt) at t=1 and this requires one investment (expenditure) now (at t=0) then:

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

DO NOT FORGET: A financial manager takes decisions at a **specific time point**
All cash flows (positive or negative) need to be expressed in present value terms

Investment makes sense if Net Present Value is positive



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

$$\text{NPV} = C_0 + \underbrace{\frac{C_1}{1+r}} \qquad \textit{If (and only if t=1)}$$

Present Value of future cash-flow

Digest the term: Present Values with multiple cash flows

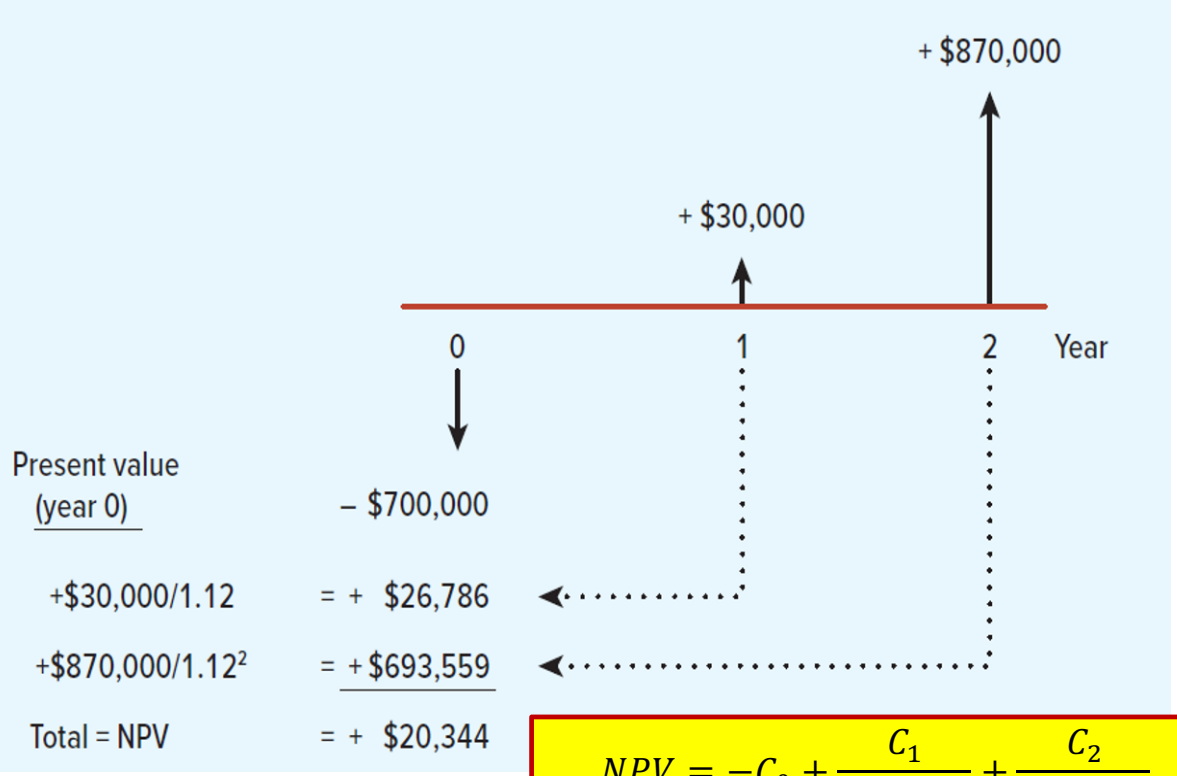
PVs can be added together to evaluate multiple cash flows.

This is the **Discounted Cash Flow** (DCF) formula:

$$PV = \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)3} + \ldots + \frac{C_t}{(1+r)^t}$$

Present Values with multiple cash flows: **DCF**

Of course, we might also just leverage on the investment in Y1, and sell after



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

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

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

How do we “price in” investment risk while calculating with PV?

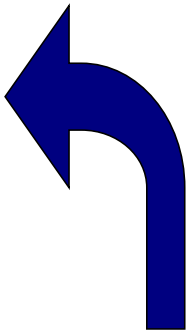
Rate of return that investors seek reflects the investment risk

- Higher risk projects imply a higher interest rate
- Higher interest rates cause lower PVs

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

PV of C_1 = 800,000 at 12% rate:

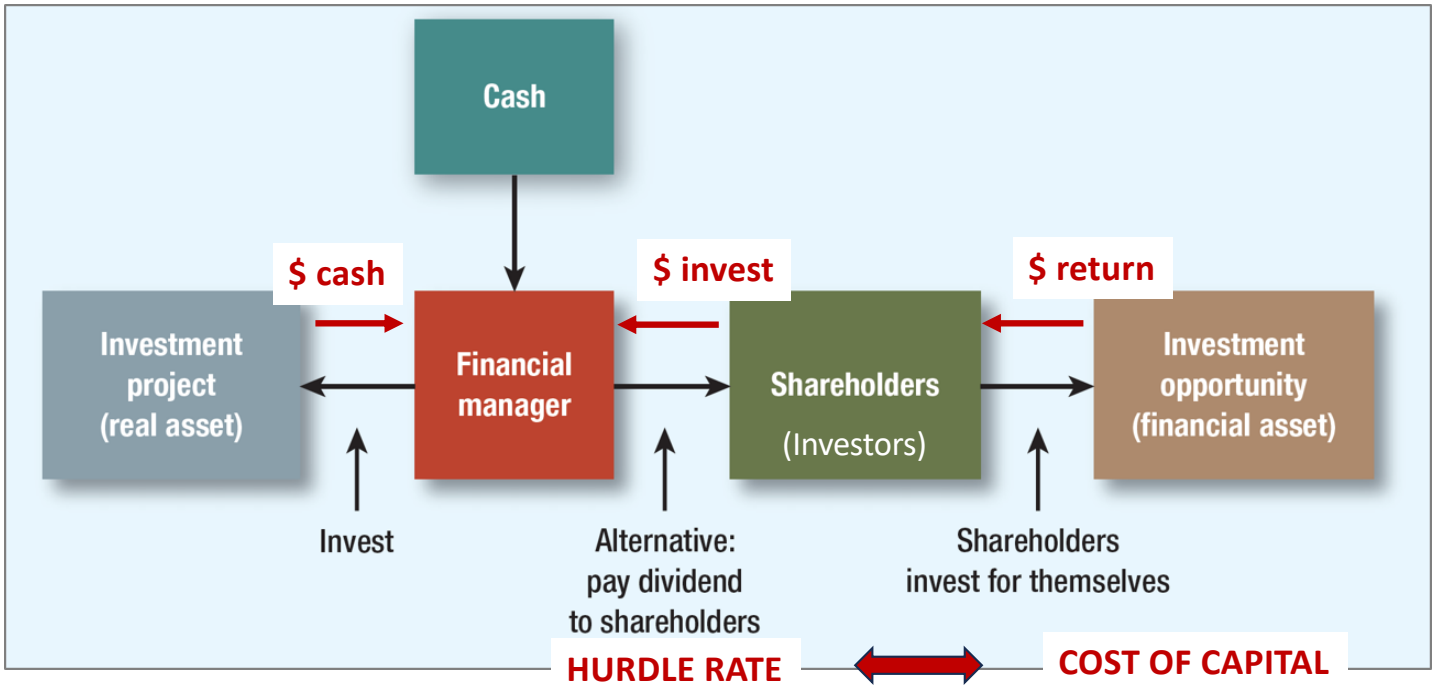
$$\text{PV} = \frac{800{,}000 \text{ GBP}}{(1+0.12)^1} = 714{,}286 \text{ GBP}$$



PV of C_1 = 800,000 at 7% rate:

$$\text{PV} = \frac{800{,}000 \text{ GBP}}{(1+0.07)^1} = 747{,}664 \text{ GBP}$$

Remember the investment trade-off:



- **Hurdle rate**: Minimum acceptable rate of return on investment for shareholders
- Shall match **opportunity cost of capital**, which depends on the investment opportunities available in financial markets

What decides upon our investment decision while considering the expected(!) rate of return?

Consider your **opportunity cost of capital!**

Rate of return rule: Accept investments that offer rates of return ***in excess*** of their opportunity cost of capital. In other words, where the hurdle rate exceeds opportunity costs, leading to a "positive" opportunity.

We have a project that will generate a cash flow of £820,000 and we need to invest £700,000. The foregone investment opportunity is 12%. Should we do the project?

If costs = $700k and income = $800k then profit = money received – money spent = $100k

$$\text{Return} = \frac{\text{profit}}{\text{investment}} = \frac{\$800,000 - \$700,000}{\$700,000} = 0.143 \text{ or } 14.3\%$$

REMEMBER: I do not consider here the time effect, I only consider the risk!

Our Principles suggest to control for time and for risk today
PV calculations help us to deal with both effects separately

Cash flows are the source of value (Principle 3). We discount for two simple reasons:

- Principle 1 – time matters: A unit money today is worth more than a unit tomorrow
- Principle 2 – risk-return trade-off + loss aversion: A ***safe*** unit is worth more than a risky one

Formulas for PV, NPV / DCF are numerical expressions of these ideas.

Risk and time in valuing investment projects is complicated

- Adjusting asset values for both time and risk is a million-worth problem of markets
- We take the two effects separately in the classroom

We did a lot in this lecture, most importantly:

- Principle 4: Incentives, conflict of interest among stakehodlers, agency theory and agency cost

- Discount factor determines the PV of future inflow

- Deciding upon investments today: We instumentalize
  - NPV (my costs today shall not be higher as the PV of prediced inflow)
  - DCF (adding up the PV of multiple cash flows of different timeframes)
  - rate of return, opportunity cost of capital and hurdle rate