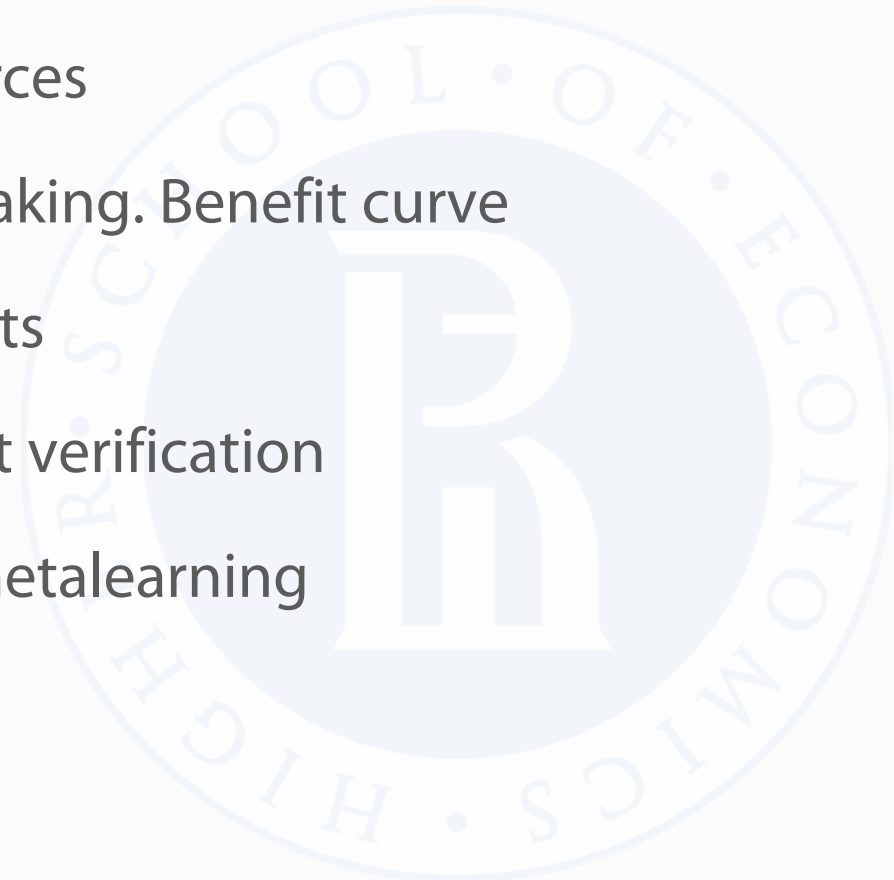# Project valuation

# Course roadmap

1. Project valuation: valuation metrics, planning and rules

    - Project valuation: Net Present Value and other valuation criteria

    - Valuation planning

    - Expenses and income sources

2. Model quality and decision making. Benefit curve

3. Estimating model risk discounts

4. A/B testing and financial result verification

5. Unobservable model errors, metalearning

# Project valuation: Net Present Value and other valuation criteria

# Object of valuation

- First step of valuation process — a determination of an object we tend to assess

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- For projects / AI initiatives the object of valuation is a fair value of what we change or create

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# Valuation period

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- The time of planning is connected with a depreciation / amortization period of assets that are needed to run the project (e.g. 5 years since ending of project tasks)
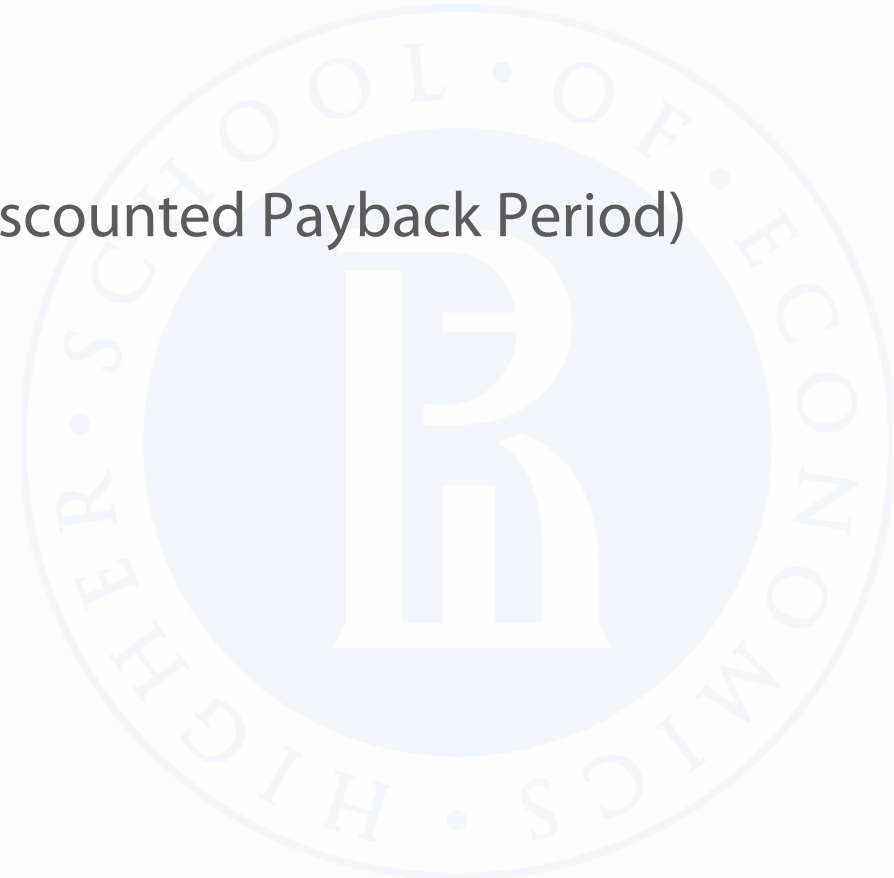
# Valuation period

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- The time of planning is connected with a depreciation / amortization period of assets that are needed to run the project (e.g. 5 years since ending of project tasks)

- The same principle is valid for AI solutions: the valuation period depends on a forecast of a model degradation and a necessity to rebuild the model (on average it's 3 years since creation)
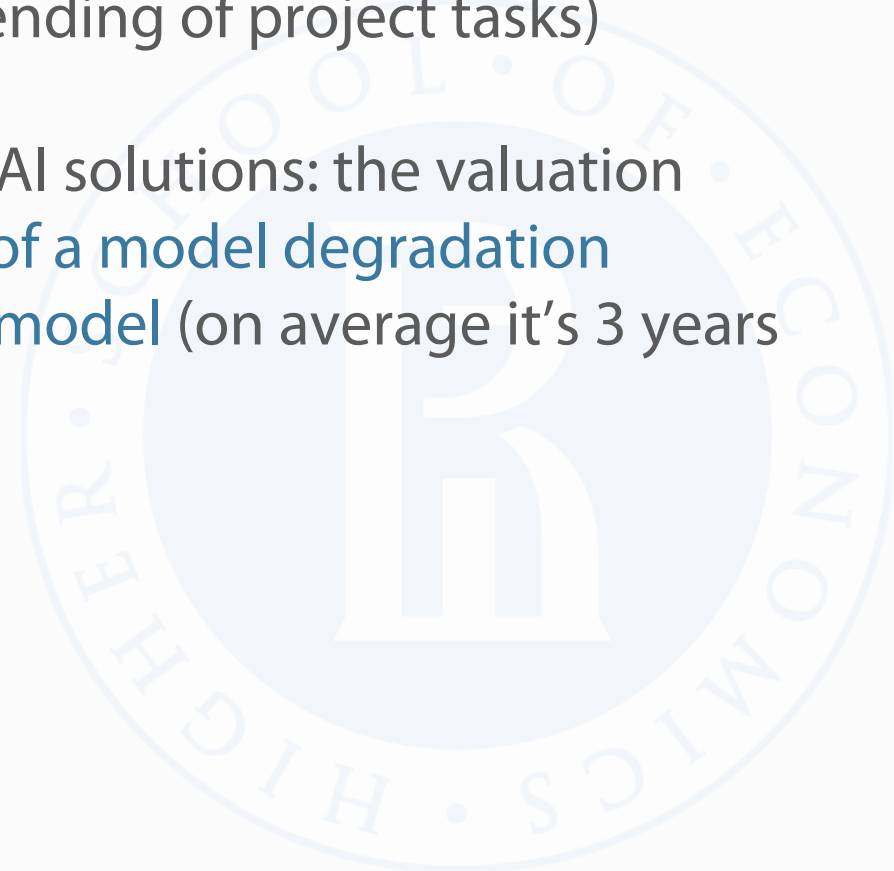
# Criteria of Project valuation

- There are different approaches to estimate the financial reasonability of our investments:

    - NPV (Net Present Value)

    - IRR (Initial Rate of Return)

    - PI (Profitability Index)

    - PP / DPP (Payback / Discounted Payback Period)

# Criteria of Project valuation

- There are different approaches to estimate the financial reasonability of our investments:

    o   NPV (Net Present Value)

    o   IRR (Initial Rate of Return)

    o   PI (Profitability Index)

    o   PP / DPP (Payback / Discounted Payback Period)

- All approaches are applicable for project valuation, but have methodological limitations and answer different business questions

# Criteria of Project valuation. NPV

$$NPV = \sum_{i=1}^{N} \left( \frac{CF_i}{(1+r)^{\frac{i}{12}}} \right)$$

$NPV$ — Net present value — current value of the sum of future inflows and outflows

$CF_i$ — cash inflows and outflows at time $i$

$i$ — month of cash flow

$N$ — total number of months for valuation, valuation period

$r$ — discount rate, cost of capital

if **NPV** $> 0$
then **Project is profitable and may be accepted**

# Criteria of Project valuation. IRR

$$NPV = \sum_{i=0}^{N} \left( \frac{CF_i}{(1 + IRR)^i} \right) = 0$$

$IRR$ — Internal rate of return — expected future rate of return for which NPV is equal to 0

$CF_i$ — cash inflows and outflows at time $i$

$i$ — month of cash flow

$N$ — total number of months for valuation, valuation period

if **IRR** > cost of capital
then **Project is profitable and may be accepted**

# Criteria of Project valuation. PI

$$PI = 1 + \frac{NPV}{Total\ costs}$$

$PI$ — Profitability index — created value per unit of costs considering the time value
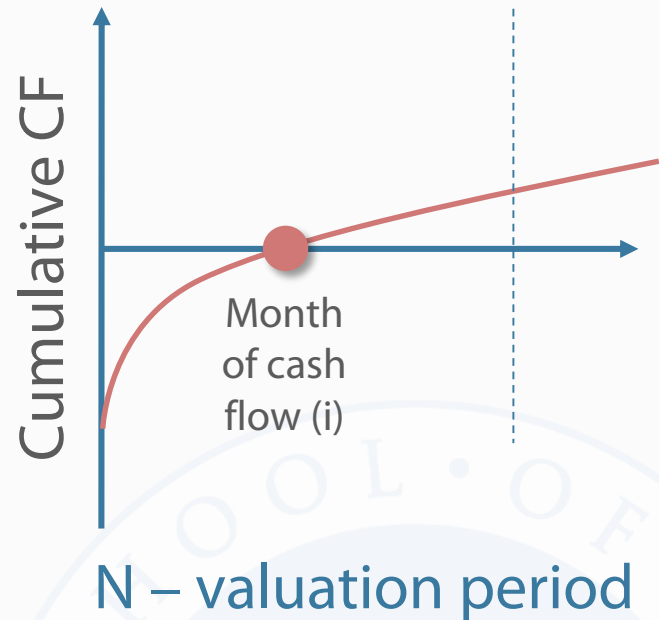
$Total\ costs$ — sum of all operational (OpEx) and capital (CapEx) project expenditures

if **PI** >1
then **Project is profitable and may be accepted**

# Criteria of Project valuation. PP, DPP

$PP$ — payback period — expected time to reach the break-even-point not taking into account the time value (cumulative cash flow is positive)



N – valuation period

$DPP$ — discounted payback period — expected time to reach the break-even-point taking into account the time value (cumulative discounted cash flow is positive)

if **PP or DPP** <valuation period
then **Project is profitable and may be accepted**

# Criteria of Project valuation. Drawbacks

**Example 1:**
we have 2 alternatives to invest with following cash flows

| Year | Project A, mln. USD | Project B, mln. USD |
|:---:|:---:|:---:|
| 0 | (15 000) | (15 000) |
| 1 | 7 000 | 3 000 |
| 2 | 6 000 | 5 000 |
| 3 | 7 500 | 9 000 |
| 4 | 4 000 | 9 000 |

$$NPV = \sum_{i=0}^{N}\left(\frac{CF_i}{(1+\boldsymbol{r})^i}\right) = 0$$

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| IRR | 24.7% | 21.5% |

$$NPV = \sum_{i=0}^{N} \left( \frac{CF_i}{(1+r)^i} \right) = 0$$

By IRR Approach Project A is more attractive
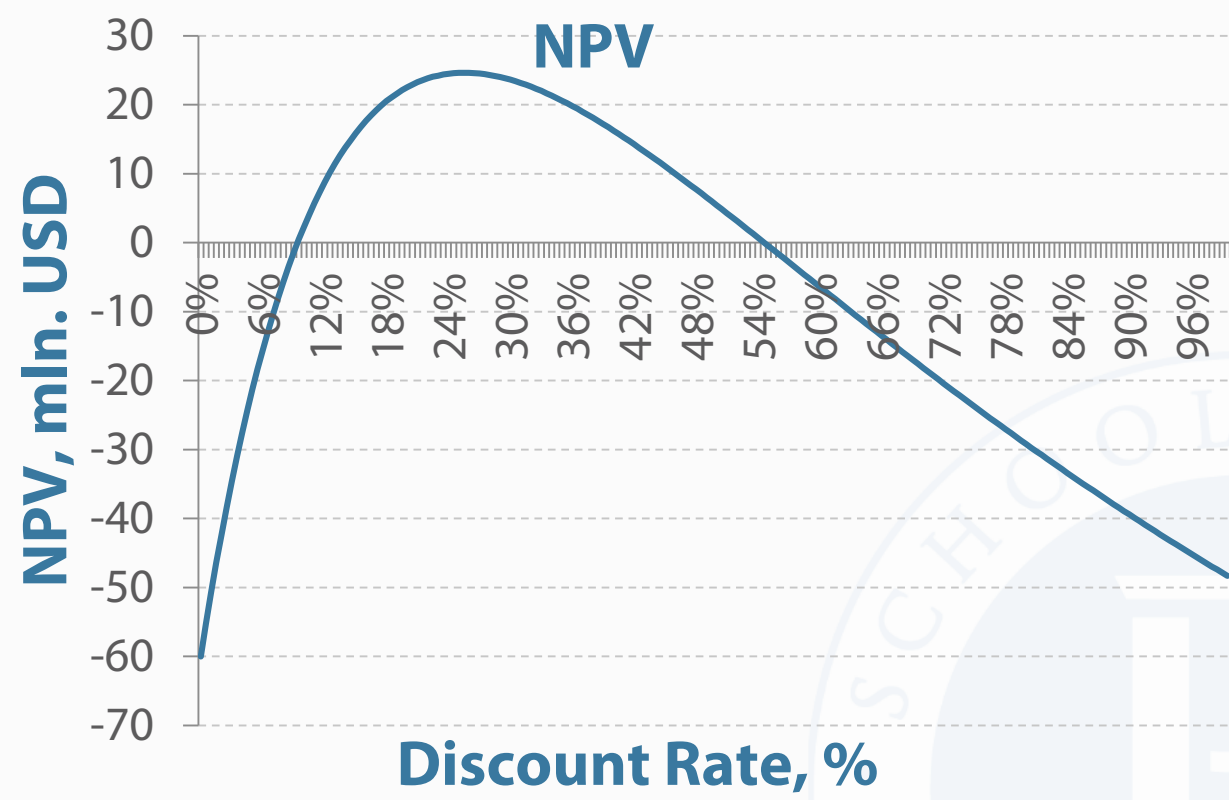
# Criteria of Project valuation. Drawbacks

**Example 2:**
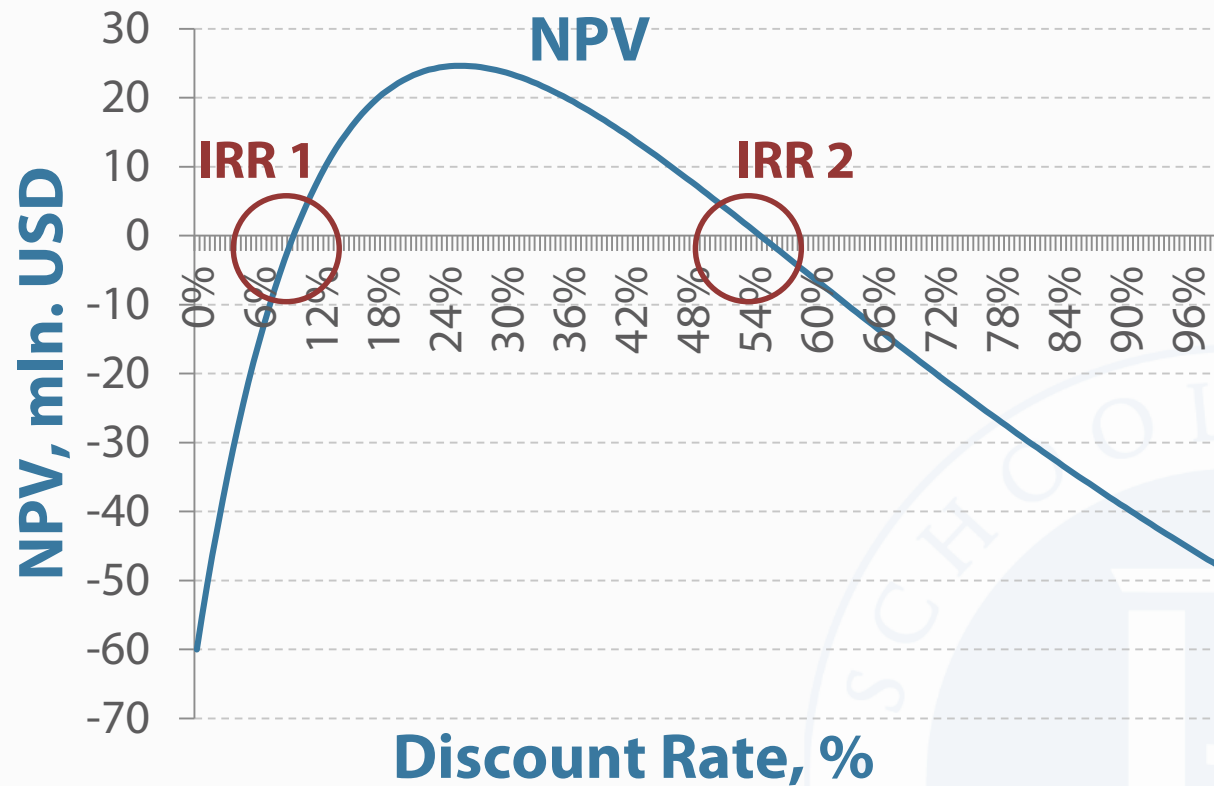we have a project with several investments (in the beginning and in the 5th year). Let's solve equitation for IRR

| Year (i) | Cash Flow, mln. USD |
|:---:|:---:|
| 0 | (180) |
| 1 | 150 |
| 2 | 170 |
| 3 | 180 |
| 4 | 100 |
| 5 | (480) |

$$NPV = \sum_{i=0}^{N} \left( \frac{CF_i}{(1 + \textbf{IRR})^i} \right) = 0$$

# Criteria of Project valuation. Drawbacks

# Criteria of Project valuation. Drawbacks



Project can have **multiple $IRR$** in case of several **negative cash flows**

# Criteria of Project valuation. Drawbacks

- *IRR / PP / DPP* have serious disadvantages that does not allow to choose the project with the highest absolute added economic value
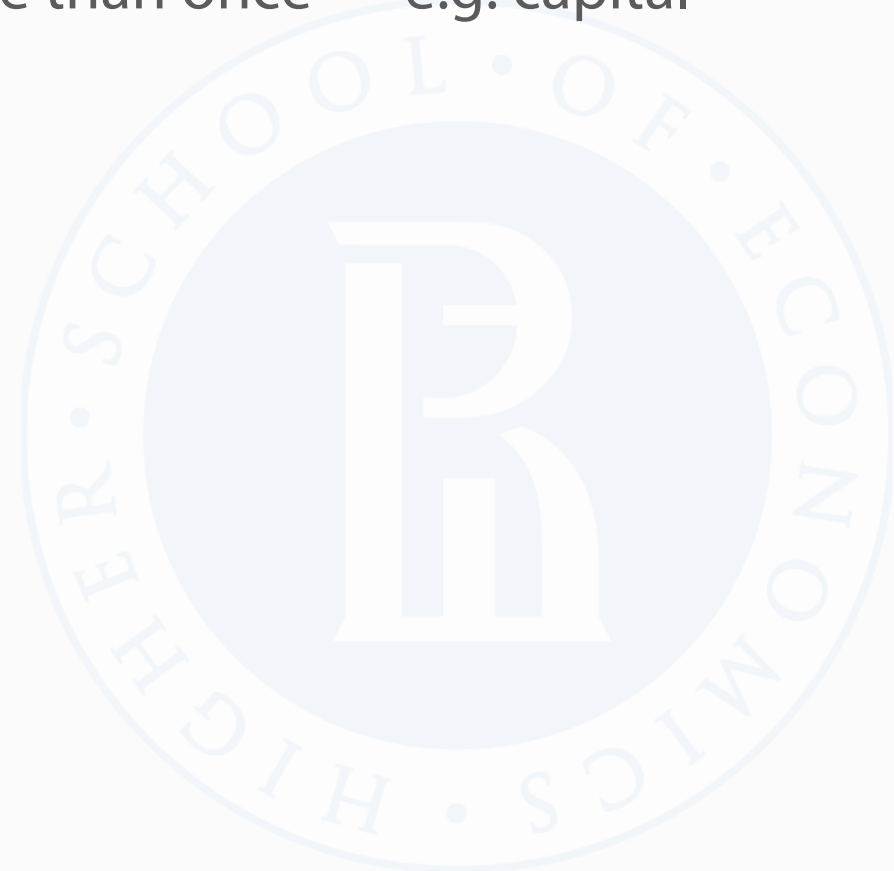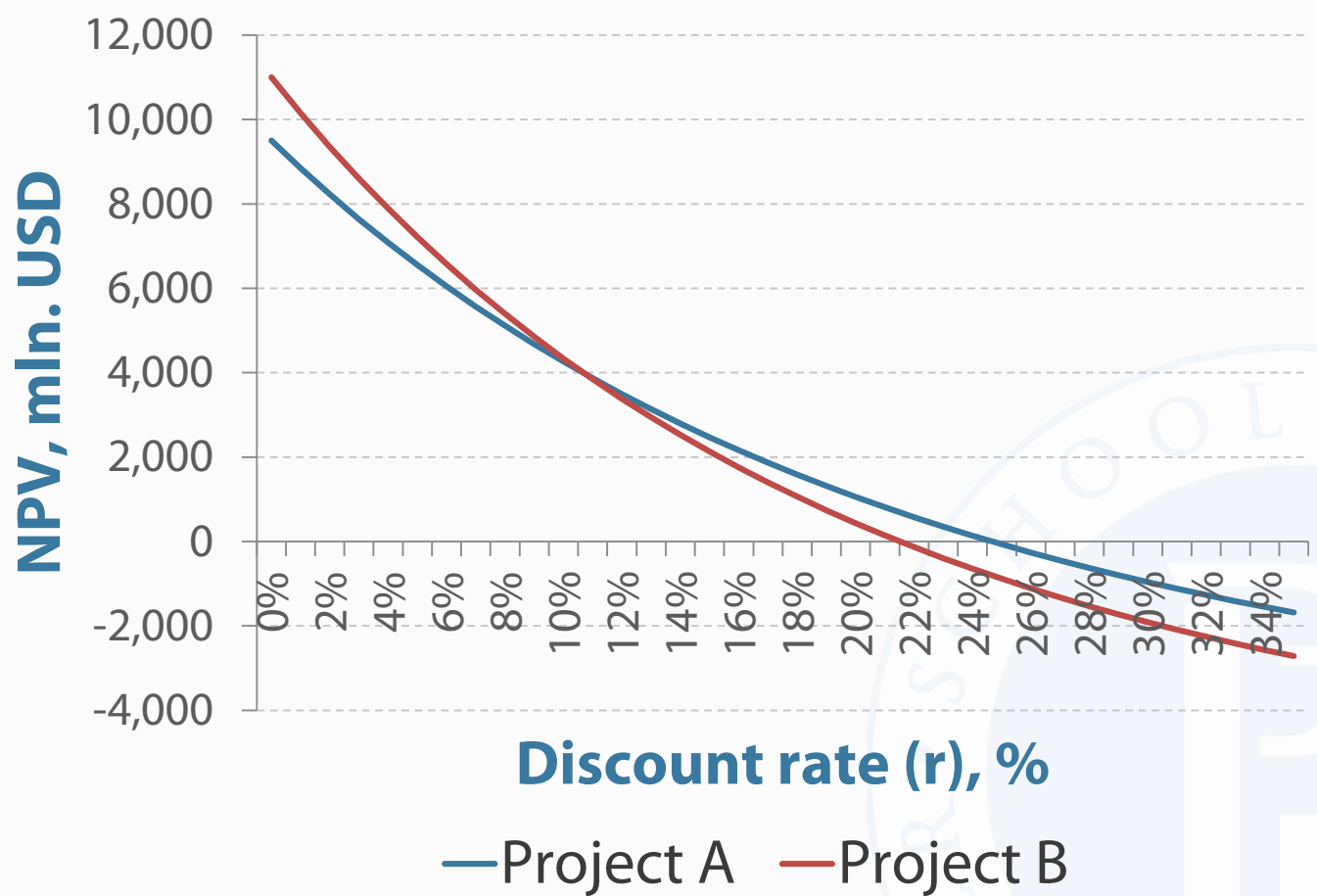
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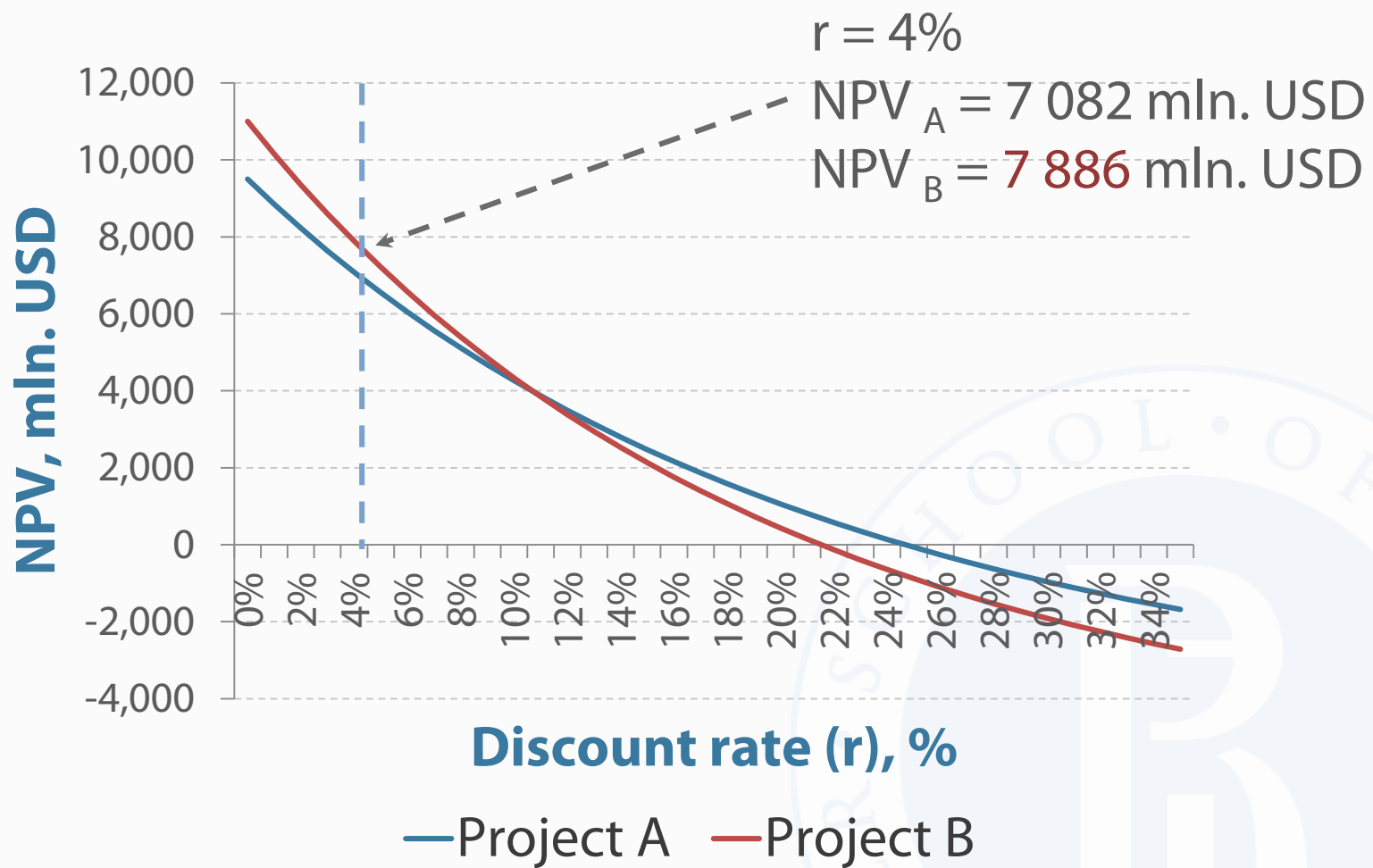- *IRR / PP / DPP* have serious disadvantages that does not allow to choose the project with the highest absolute added economic value

- Project can have multiple *IRR / PP / DPP* (if the sign of the cash flow changes more than once — e.g. capital investments every year)

# Criteria of Project valuation. Drawbacks

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r = 4%

$NPV_A = 7\,082$ mln. USD

$NPV_B = 7\,886$ mln. USD

# Criteria of Project valuation. Drawbacks



r = 4%
$NPV_A = 7\ 082$ mln. USD
$NPV_B = 7\ 886$ mln. USD

r = 18%
$NPV_A = 1\ 584$ mln. USD
$NPV_B = 1\ 062$ mln. USD

NPV, mln. USD

Discount rate (r), %

— Project A  — Project B

# Criteria of Project valuation. Drawbacks



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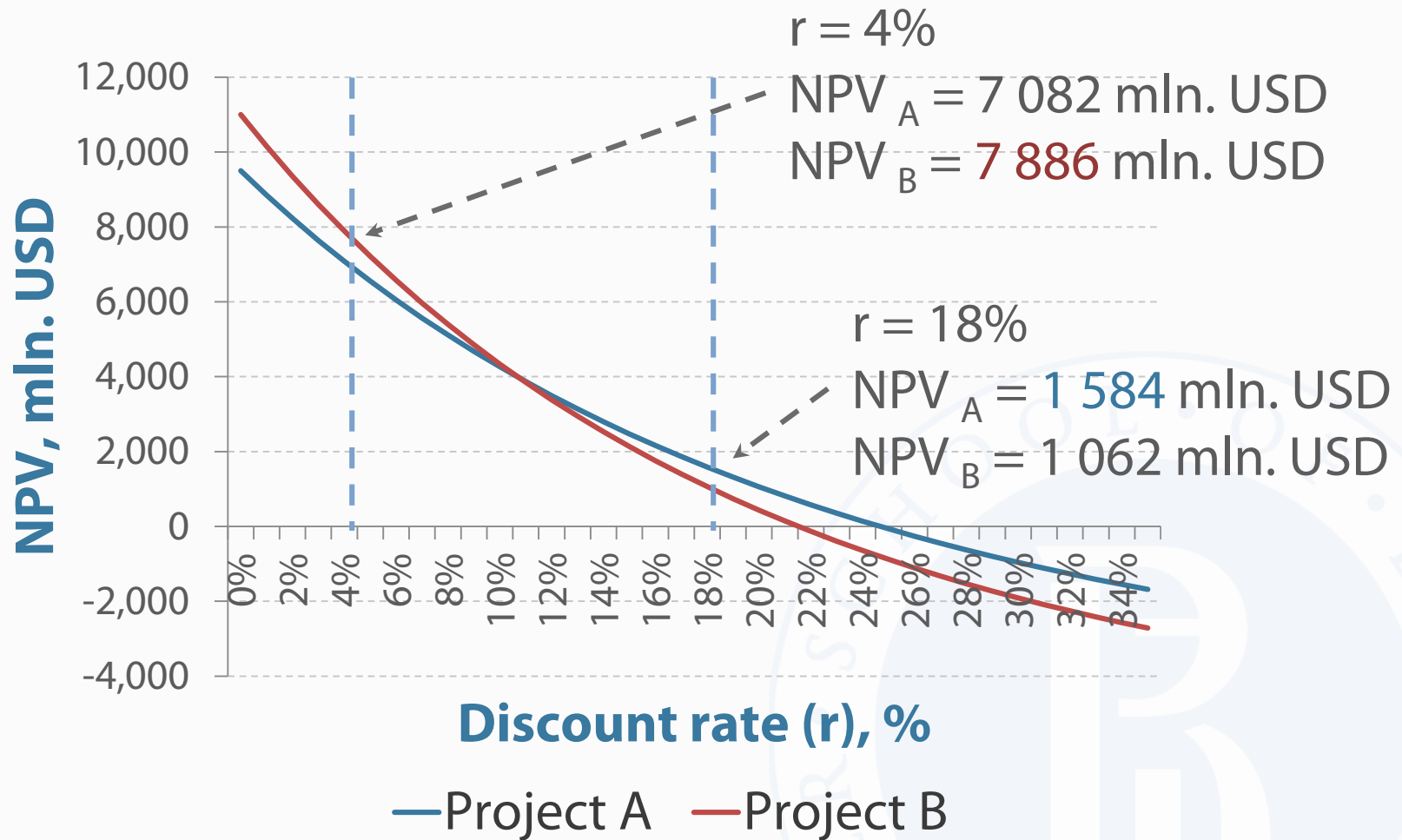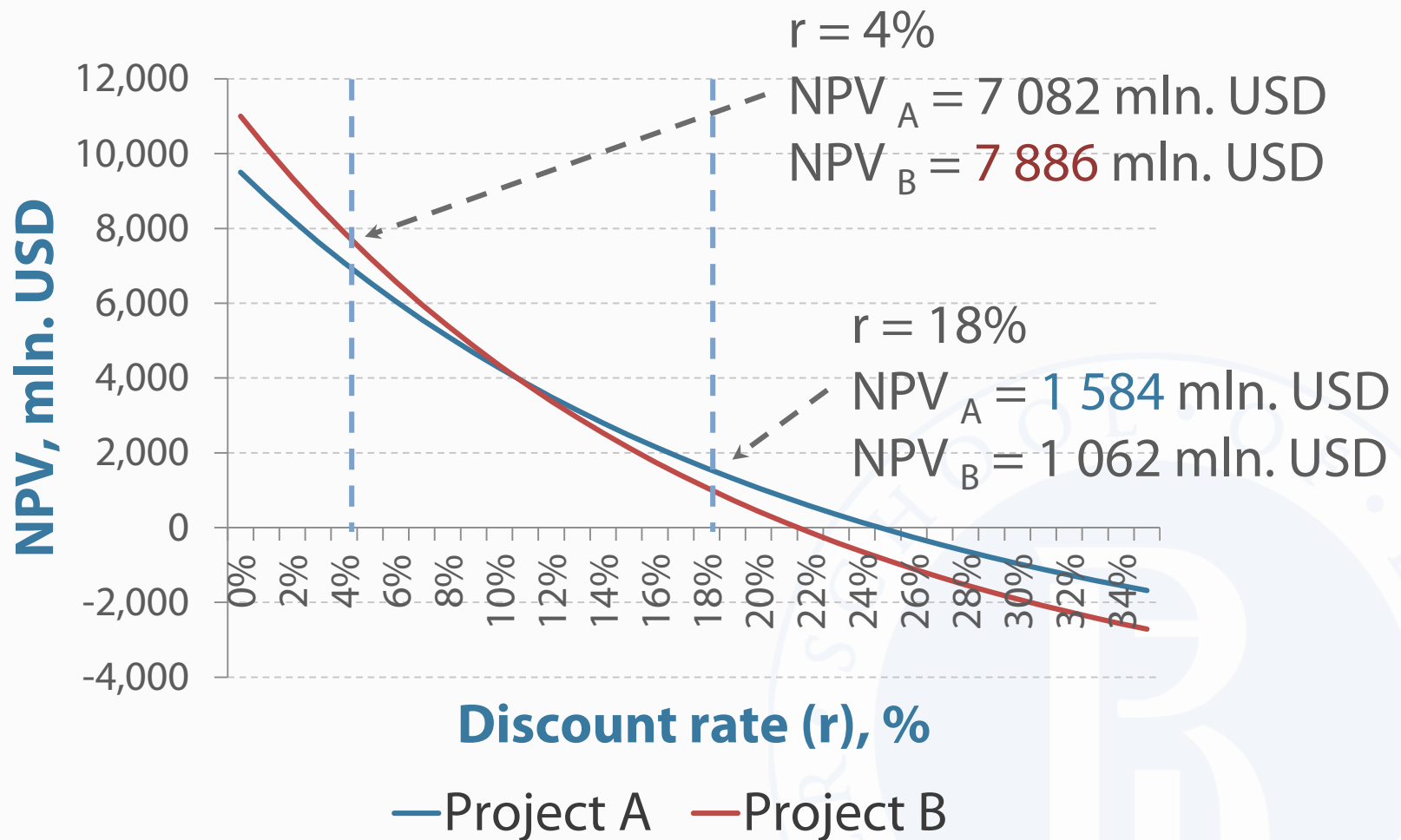
— Project A   — Project B

Decision based on **NPV approach** varies depending on the **discount rate** used.

# Criteria of Project valuation. Drawbacks

- NPV approach implies a possible difficulty in determining the required rate of return and forecasting cash flows (too pessimistic / optimistic forecast influences the decision)

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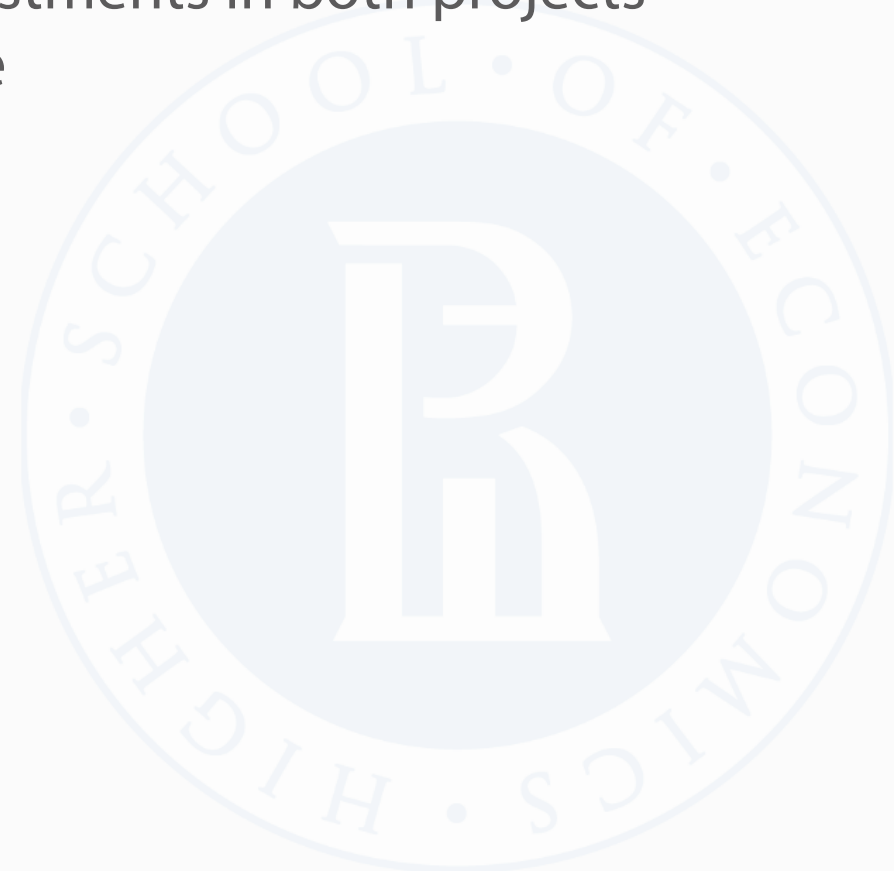
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  ✅ Taking into consideration all advantages and disadvantages of all approaches NPV method is considered to be the main in project valuation

# Wrap-up

1. Among different approaches to make a financial decision about project (NPV, IRR, PI, PP, DPP) the NPV method is considered to be the main in a project / AI valuation

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2.  Positive NPV value implies that allocated resources create positive added economic value

# Valuation planning

# Object determination

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- For ground breaking products based on AI solutions we have to analyze and describe all inputs and outputs of a new process that we are creating

- For AI solutions that improve current performance we have to analyze and describe all changes in business processes that are needed to implement the solution

# Process analysis

In order to make the map of the project with all inputs and outputs the following questions must be analyzed:

1. What is the process / product we are going to change or create?

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6. Are there any benchmarks we can use for forecast?

7. What are the risks we may face?

# Process analysis. Project profile example

| Project name | | Project leader | |
|---|---|---|---|
| **Problem and solution description** | | | |
| | | | |

**Aims and KPI**

| Aim / KPI | Current value | Target value | Dates of control and monitoring |
|---|---|---|---|
| | | | |

| Project team | Project boundaries, process analysis | Expenses and income analysis | |
|---|---|---|---|
| | | | |

| Pilot / AB-test design description, roadmap | | Key risks | |
|---|---|---|---|
| | | | |

# 6 Valuation Principles: Objectivity principle

- In valuation process calculations, accounting and assumptions must be based on solid evidence, factual data and statistics

- Following expert forecast for future cash flows with no factual baseline creates the risk of wrong biased decision influencing the financial results

# 6 Valuation Principles: Measurability principle

- All possible inflows (benefits) and outflows (costs) must be measurable

- The factors that we plan to influence must be assessed before and after project implementation

- All parameters of the project that are crucial for future benefits and risks must be fixed as KPI (Key performance indicators)

# 6 Valuation Principles: Conservatism principle

- Valuation process implies an uncertainty situation about future cash flows when there are different possible outcomes that are equally likely

- In such situation expenses must be accounted at a highest possible level and income at a lowest possible level

# 6 Valuation Principles: Completeness principle

In project valuation we have to take into account all the incremental costs and benefits that occur to achieve business goals of a project and maintain the process:

- costs on DS specialists, analytics,

- operational and capital expenditures,

- IT resources

# 6 Valuation Principles: Materiality principle

- There is no need to take into account the effects that have small impact on financial results

- To define the materiality threshold we need to analyze the NPV sensitivity to positive and negative effects that we tend to evaluate more accurately

# 6 Valuation Principles: Performance monitoring

- All essential parameters that determine the financial results must be fixed as KPI (Key performance indicators)

- KPI should be both financial (e.g. 10% growth of interest income) and non-financial (e.g. 8% growth of response rate in active sales) as we have specific parameters that project is going to influence

# FCFE vs FCFF

- FCFF — Free Cash Flow to Firm

- FCFE — Free Cash Flow to Equity

| Main differences | FCFF | FCFE |
|---|---|---|
| Value analysis | For all investors | For equity shareholders |
| Who prefers | Highly leveraged companies | Banks, companies with primary equity financing |
| Discount rate | Weighted Average Cost of Capital (WACC) | Cost of equity |

FCFF shows total investments and is preferred to calculate PP / DPP

# FCFE vs FCFF

$FCFE =$
$= Net\ Income + Depreciation\ \&\ Amortization -$
$Long\ Term\ Investments - Working\ Capital\ Investment +$
$Net\ Borrowing$

$FCFF =$
$= FCFE + Interest \cdot (1 - Tax\ rate) - Net\ Borrowing$

# WACC

$$WACC \text{ } for \text{ } FCFF =$$

$$= \left( \frac{Debt}{Debt + Equity} \cdot r_d \cdot (1 - Tax \text{ } rate) + \frac{Equity}{Debt + Equity} \cdot r_e \right)$$

$r_d$ — cost of debt (%)

$r_e$ — cost of equity (%)

$Debt$ — external source of financing, borrowings

$Equity$ — internal financing, shareholders' funds

# Cost of equity.
# Capital Asset Pricing Model (CAPM)

$r_e = cost\ of\ equity = r_{risk\_free} + \beta \cdot Market\ risk\ premium + Country\ risk\ premium + Size\ premium$

$r_{risk\_free}$ — risk-free rate of interest (e.g. 10-years US treasury bonds)

$Market\ risk\ premium$ — difference between market rate of return and risk-free rate

$\beta$ — "beta", the measure that shows the sensitivity of a stock with respect to the market in general

*Sources for premiums and beta: Ibbotson, Bloomberg*

# Wrap-up

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1. There are 6 main principles we have to follow in the valuation process to have a reliable estimate: objectivity, measurability, conservatism, completeness, materiality, performance monitoring

2. Before any estimations we need to make an analysis and define a map of possible risks and consequences for all current processes because of our solution implementation
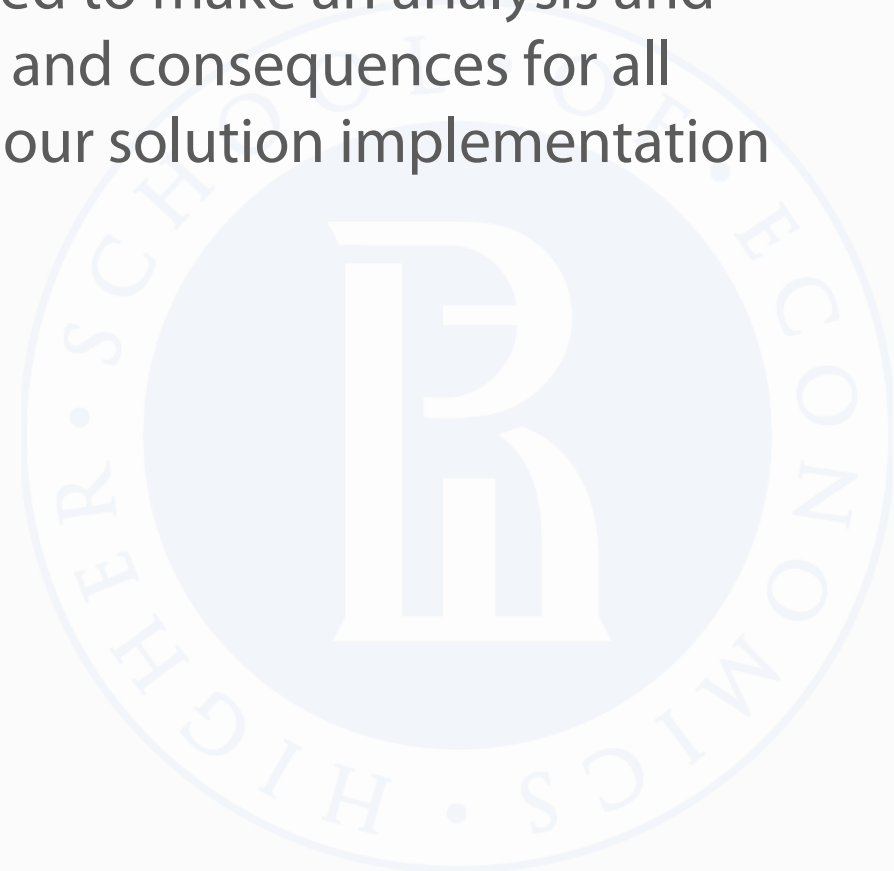
# Expenses and income sources

# Expenses

For NPV calculating we have to take into consideration all resources that are needed to create the solution:

- Allocated current company resources,

- Increased costs / investments

# Expenses

4 types of expenses:

1. Allocated current human resources
   (total labor costs + indirect costs)

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    (OpEx, e.g. data purchase, consulting, marketing, growth
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    IT resources (servers, licenses, maintenance costs)

3.  Operational expenditures — new ongoing expenses
    (OpEx, e.g. data purchase, consulting, marketing, growth
    of labor costs, electricity costs)

4.  Capital expenditures (CapEx, investments in long-term
    assets — buildings, equipment, vehicles, land)

# Income

To evaluate a positive effect of a project / AI solution we need to define what is the source of a possible effect.

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To evaluate a positive effect of a project / AI solution we need to define what is the source of a possible effect.

There are 6 basic sources of income:

- Sales growth

- Operational costs cutting

- Operational risks cutting

- Losses reduction

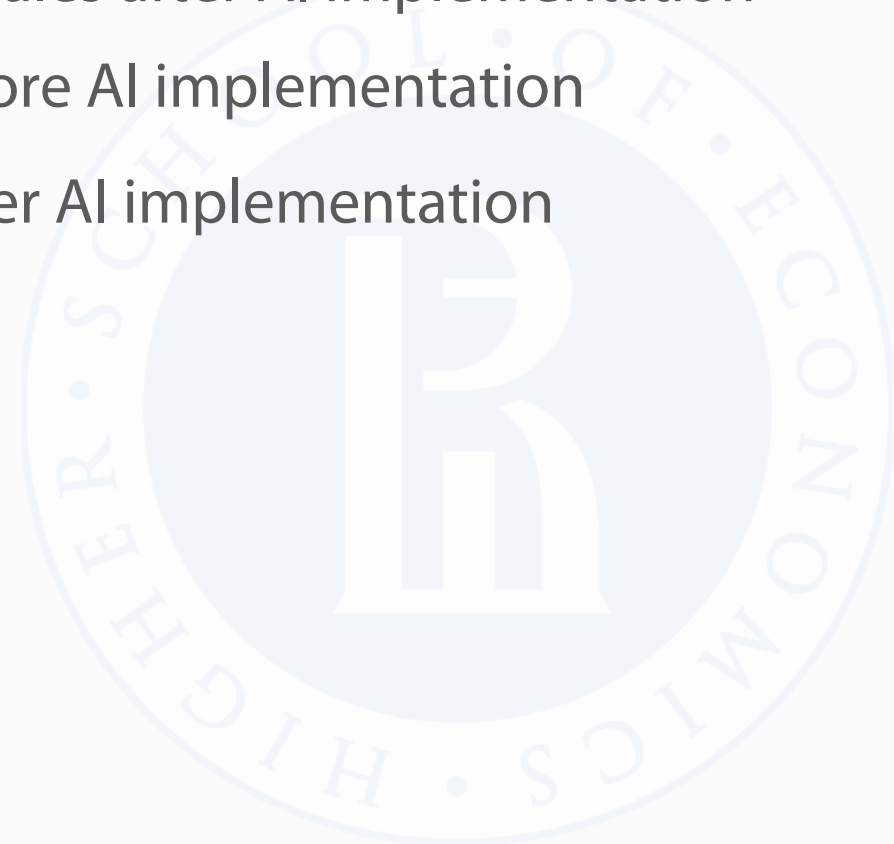- WACC reduction

- Liquidity management

# Sales Growth

$$Effect = \overline{NPV_{new\ sales}} \cdot Q_{new\ sales} - \overline{NPV_{old\ sales}} \cdot Q_{old\ sales}$$

$\overline{NPV_{old\ sales}}$ — average NPV of sales before AI implementation

$\overline{NPV_{new\ sales}}$ — average NPV of sales after AI implementation

$Q_{old\ sales}$ — number of sales before AI implementation

$Q_{new\ sales}$ — number of sales after AI implementation

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$Q_{new\ sales}$ — number of sales after AI implementation

**❗ Nota bene!**
We have to analyze the sales change of all related substitutes to take into account the effect of cannibalization

# Operational Costs / Risks / Losses cutting

$$Effect = Costs\ \&\ Losses_{new} - Costs\ \&\ Losses_{old}$$

**Step 1:** analyze the sources and drivers of costs and losses

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**Step 2:** determine current indicators per operation / unit to control and verify our assumptions while piloting

**Step 3:** analyze and define possible long-term deferred effects concerning product features
(e.g. for long-term loans the valuation of final loss cutting / growth effect is possible only after at least 12 months after sale is made because of social and demographic factors)

# WACC reduction

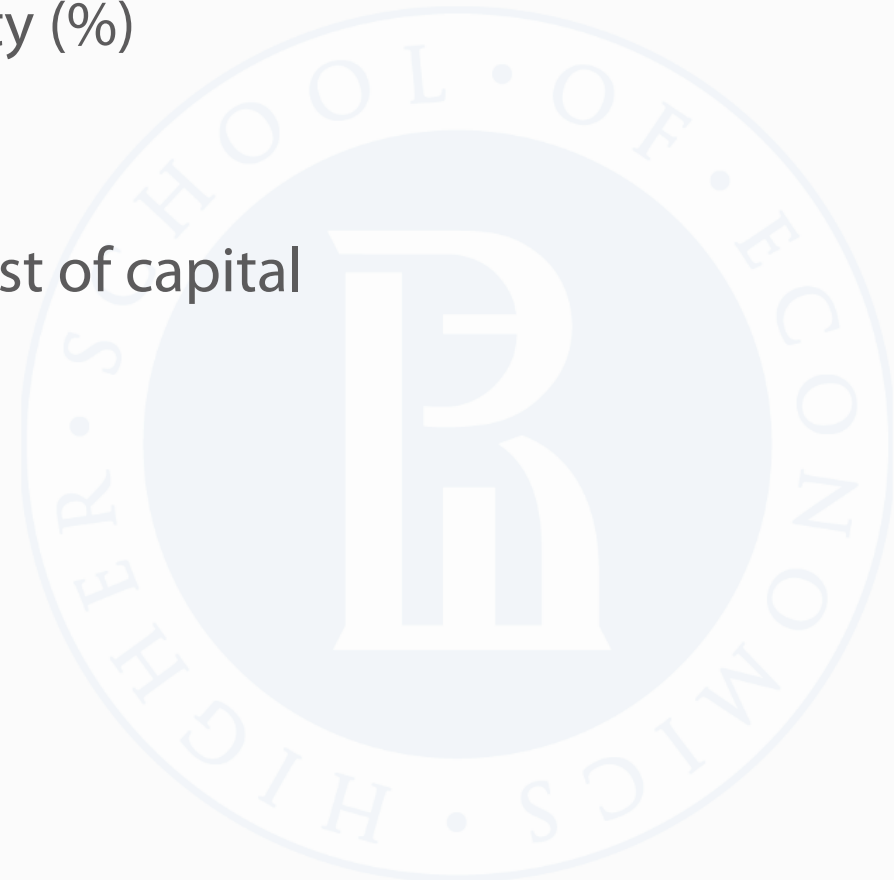$$Effect = WACC_{new} - WACC_{old}$$

$$WACC = w_{debt} \cdot r_{debt} \cdot (1 - Tax) + w_{equity} \cdot r_{equity}$$

$r$ — the cost of debt / equity (%)

$w$ — the portion of a debt / equity (%)

$Tax$ — profits tax (%)

$WACC$ — a weighted average cost of capital

# WACC reduction

$$Effect = WACC_{new} - WACC_{old}$$

- The effect on WACC can be achieved through using of cheaper sources of financing (debt) instead of equity (shareholders' funds)

- This effect type is essential for banks as they have regulatory requirements for reserves and equity (adequacy ratios)

# Liquidity management

$$Effect = Interest\ Income_{new} - Interest\ Income_{old} =$$

$$Free\ cash_{new} \cdot Interest\ rate_{new} \cdot \frac{Days\ of\ Deposit\ Term_{new}}{365} -$$

$$Free\ cash_{old} \cdot Interest\ rate_{old} \cdot \frac{Days\ of\ Deposit\ Term_{old}}{365}$$

Liquidity management effect implies the opportunity to have more free cash that can be turned into a time deposit for a set period of time

# Wrap-up

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1. Before making decision of creating and implementation of the AI solution we have to determine the necessity of current company resources to allocate to a project and possible increase in expenses

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3. There are 6 basic sources of income: sales growth, operational costs cutting, operational risks cutting, losses reduction, WACC reduction, liquidity management