

Capital budgeting

Lecture for Corporate Finance



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Outline of the lecture



- Capital budgeting
- Evaluation of investments
- Net Present Value (NPV)
- Internal Rate of Return (IRR)
- Profitability index (PI)
- Pay Back Period method (PBP)



- **Capital budgeting** is a process used by companies for evaluating and ranking potential expenditures or investments that are significant in amount.
- The large expenditures could include the purchase of new equipment, rebuilding existing equipment, purchasing delivery vehicles, constructing additions to buildings, etc.
- The large amounts spent for these types of projects are known as capital expenditures.
- **Capital budgeting** usually involves the calculation of each project's future accounting profit by period, the cash flow by period, the present value of the cash flows after considering the time value of money, the number of years it takes for a project's cash flow to pay back the initial cash investment, an assessment of risk, and other factors.

Definition of investment

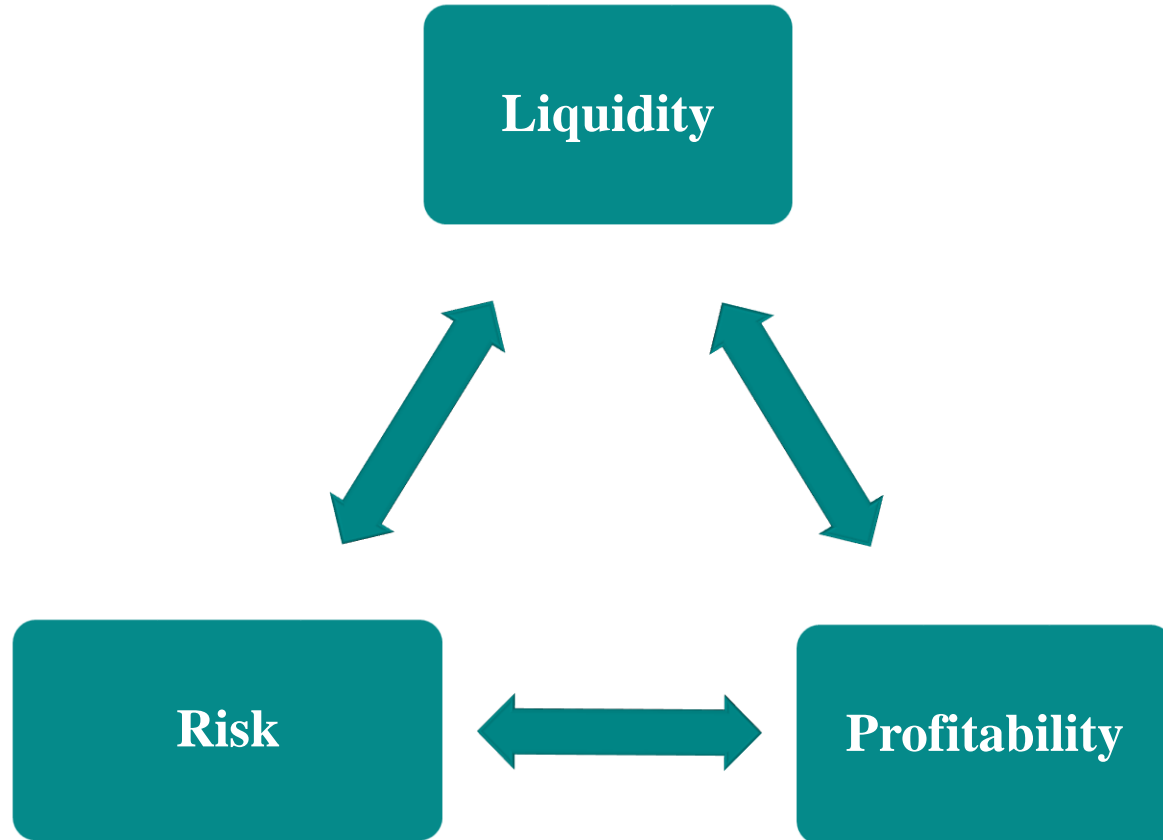


- Investment can be defined as a deposit of temporarily free funds in assets which are not used for direct consumption.
- **Each investment is characterized by :**
 - *maturity date* - the period for which the funds were invested,
 - *returns* - all cash flows from the investments throughout its existence, or the period for which the given entity owns it,
 - *liquidity* - the rate of the velocity at which the investment asset can be converted back into cash.
- Temporarily free funds are available part of the savings. The investment is then to maximize the benefit of the investor.
- **The time value of money** is a key concept in financial management, respectively corporate finance. It is important for company's investments, financing and dividend decisions, which result in significant cash flows over a variety of time periods.



- **The concept of the time value of money**, which says that a dollar today is worth more than a dollar tomorrow. This is one of the most basic and important concepts in finance.
- Instead, the time value of money is based exclusively on the fact that your money can earn interest. Any amount of cash today is worth more than the same amount of cash tomorrow. Tomorrow, it will be the same amount plus interest.
- Value of money refers to the fact that the value of money changes over time.
- **Reasons of time value of money:**
- *Time* - you prefer money now, because you can spend it. You can buy whatever you want. You can invest it, if you do not want to spend it now and profit from it. In every case you take it now.
- *Influence of inflation* - if you take money now, you can buy some certain amount of products, which you could not buy in one year, because they will be more expensive. Inflation causes increase of their price.
- *Risk* - if you take money now, nobody can take it back. It is yours instead of the situation that somebody promised you 100 € in one year and something would happen and you would not get them or at least not all of it.

Magical investment triangle



- While investing there is a decision, if higher rate of profit with adequate high risk is more important than quite secure investment with lower risk and rate of profit.
- Reaching the maximum in all three vertices of the triangle is impossible!!!!
- **The 100% safe, liquid and profitable investment does not exist.** Any time the investment moves on triangle sides.

Methods of investment evaluation



Following four methods are usually used for **the evaluation of capital investment proposals**:

- The average rate of return method - ARR
- The payback period method (also known as cash payback period method) - PBP
- The net present value method - NPV
- The internal rate of return method – IRR

Methods that don't use present value

Methods that use present value

The average rate
of return method

Payback period
method

Net present
value

Internal rate of
return method

Index of
profitability

- **Methods that use present values** (net present value method and internal rate of return method) in the capital investment analysis take into account the time value of money. The concept is that the money has value over time because it can be invested to earn interest income.
- **Methods that do not use the present value** (average rate of return method and payback method) are easy to use. Management uses these methods initially to screen proposals. If a proposal meets the minimum standards set by management, it is subject to further analysis otherwise it is dropped from further consideration.

Net Present Value



The net present value method uses present value concepts to compute the net present value of the cash flows expected from a proposed investment.

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

NPV ... net present value

C ... cash flow

r ... rate of return

n ... time

The rate of return or interest factor or alternative costs, used in present value analysis is determined by management.

The rate is often based upon such factors as the nature of the business enterprise and its relative profitability, the purpose of the capital investment, the cost of securing funds for the investment, and the minimum desired rate of return.

The net present value capital budgeting rule states that you should **accept projects with a positive NPV** and reject projects with a negative NPV.

$$NPV > 0$$

Net Present Value – advantages and disadvantages



It is the only method without drawback.

Advantages:

- It takes into account all cash flows
- Discounts - considers the time value of money
- Includes alternative costs
- The above maximizes the market value of the firm or the wealth of the investor

Disadvantages:

- A disadvantage is that the computations are more complex than those for the methods that ignore present value.
- The net present value method assumes that the cash received from the proposal during its useful life can be reinvested at the rate of return used in computing the present value of the proposal. This assumption may not always be reasonable due to the changing economic conditions.

In a perfect world, if you have all the right inputs to NPV, no other rule can make better decisions. Thus, it is the appropriate decision benchmark — and no other rule can beat it. This also means that information other than the NPV is redundant.

NPV - consumption or investments



- Regardless of when you need or want cash you are better off taking all positive - NPV projects - your investment decision, and then using the capital markets to shift consumption to when you want it. It makes no sense to let your consumption decisions influence your investment decisions.
- This is called the separation of decisions: You can make investment decisions without concern for your consumption preferences.
- However, this separation of investment and consumption decisions does not always hold in imperfect markets, in which you can face different borrowing and lending interest rates. You might take more projects if you have more cash.

Example NPV



1. Evaluate the following project using the NPV method when the alternative cost is 5% p.a. .:

Cash flows (USD)	C ₀	C ₁	C ₂	C ₃
	- 54,500	25,000	25,000	5,000

$$NPV_{project} = -54,500 + \frac{25,000}{1.05^1} + \frac{25,000}{1.05^2} + \frac{5,000}{1.05^3}$$

- A positive value is worthy.

NPV: Comparison of two projects



2. Evaluate and assess the following projects using the NPV method if you know that the alternative cost is 8%. Please comment on the results.

	Year	Project A	Project B
C_0	2019		-50,000
C_1	2020	-100,000	-50,000
C_2	2021	200,000	50,000
C_3	2022		50,000
C_4	2023		50,000
C_5	2024		10,000
C_6	2025	200,000	

$$NPV_A = -\frac{100,000}{1.08^1} + \frac{200,000}{1.08^2} + \frac{200,000}{1.08^6}$$

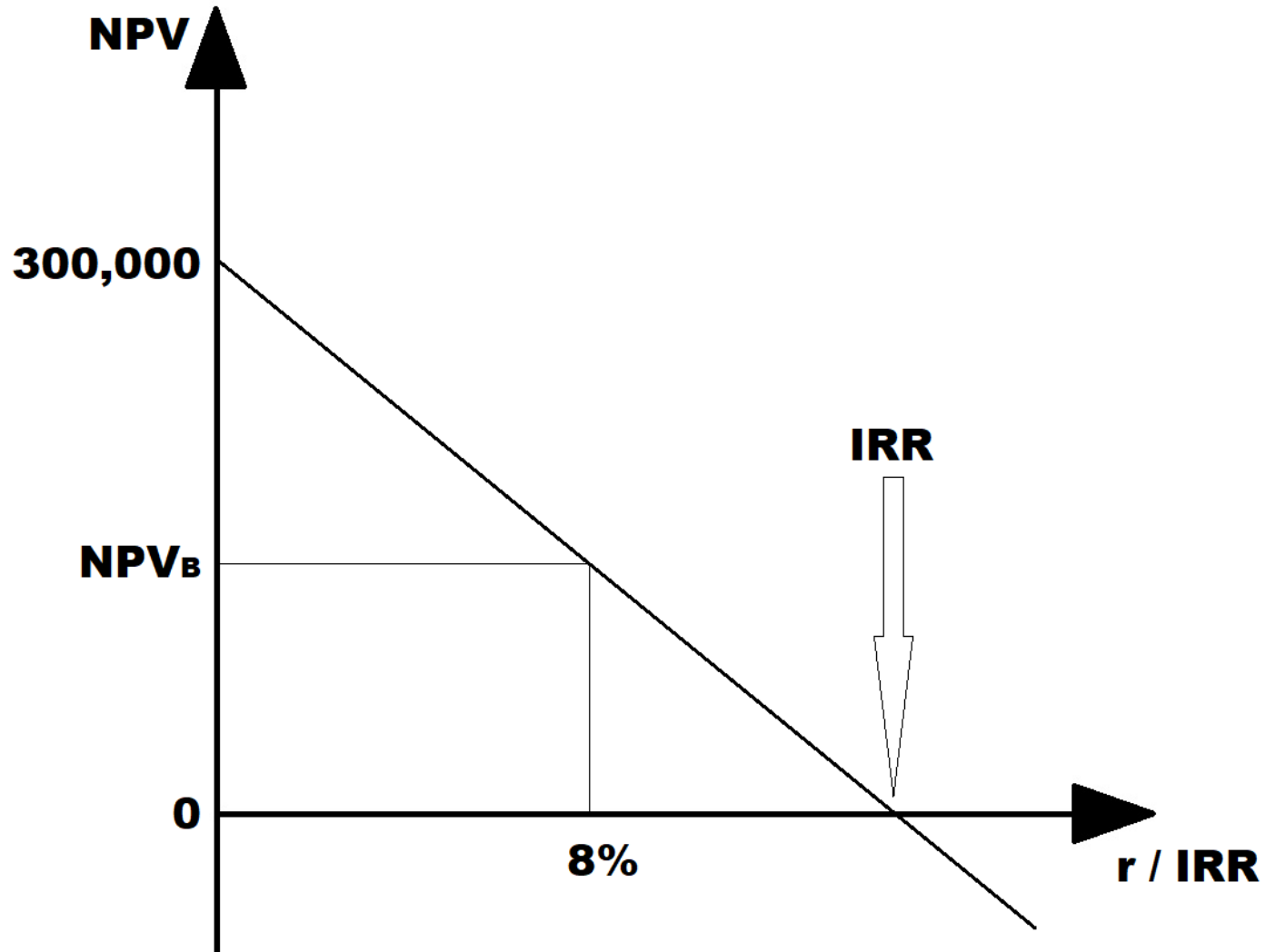
$$NPV_B = -50,000 - \frac{50,000}{1.08^1} + \frac{50,000}{1.08^2} + \frac{50,000}{1.08^3} + \frac{50,000}{1.08^4} + \frac{10,000}{1.08^5}$$

NPV commentary



Please, remember, You have to paint a graph:

- **First**, You have to calculate ZERO point on the vertical axes.
- **Second**, somewhere below that point there lies your result for NPV.
- **Third**, the breaking point on the horizontal axes means Internal Rate of Return (IRR)



Internal rate of return method



Internal rate of return method is also known as time adjusted rate of return method.

This method uses the concept of present values to compute the rate of return from expected net cash flows from capital investment proposals.

This method is very similar to the net present value method of capital investment evaluation. The net present value method focuses on the present value of net cash flows. However the internal rate of return method starts with the net cash flows and, in a sense, work backwards to determine the rate of return expected from the proposal.

$$0 = C_0 + \frac{C_1}{(1 + IRR)} + \frac{C_2}{(1 + IRR)^2} + \dots + \frac{C_n}{(1 + IRR)^n}$$

IRR ... internal rate of return
C ... cash flow
n ... time

Value of IRR must be compared ex post with alternative costs (discounted rate - r). If the value is higher ($IRR > r$) the project should be accepted, if the value is lower ($IRR < r$) the project should be rejected and if the value is equal to discounted rate, it means that rate of return from the project is exactly the same as discounted rate.

- $IRR > r$ project should be accepted;
- $IRR < r$ project should be rejected;
- $IRR = r$ project is acceptable.

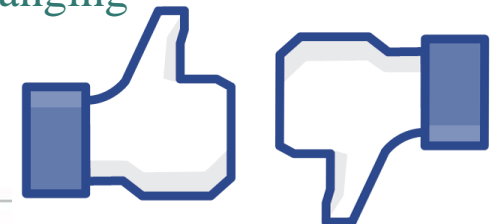
Internal rate of return – advantages and disadvantages

Advantage:

- The present value of the cash flows over the entire useful life of the investment proposal is considered.
- All investment proposals are placed on a common basis for comparison by determining a rate of return for each proposal.

Disadvantages:

- The computations are more complex than any other method of evaluating investment proposals.
- If there are more than three cash flows and evaluation by IRR method is demanded, then mathematic solution becomes more difficult with more cash flows. It is possible to use some special programs for calculation or calculators on internet.
- Ease of comparison makes IRR attractive, but there are limits to its usefulness. For example, IRR works only for investments that have an initial cash outflow (the purchase of the investment) followed by one or more cash inflows.
- IRR does not measure the absolute size of the investment or the return.
- Internal rate of return method assumes that the cash received from a proposal during its useful life will be invested again at the internal rate of return. But it may not always be reasonable because of changing economic conditions.



Example IRR



3. The project requires an investment of CZK 10,000 and will bring CZK 10,700 after a year. Use the IRR method to determine whether you will invest in a project if the interest rate on deposits redeemable at notice is 6% and 9% p.a.

$$0 = -10,000 + \frac{10,700}{(1 + IRR)^1}$$

$$1 + IRR = \frac{10,700}{10,000}$$

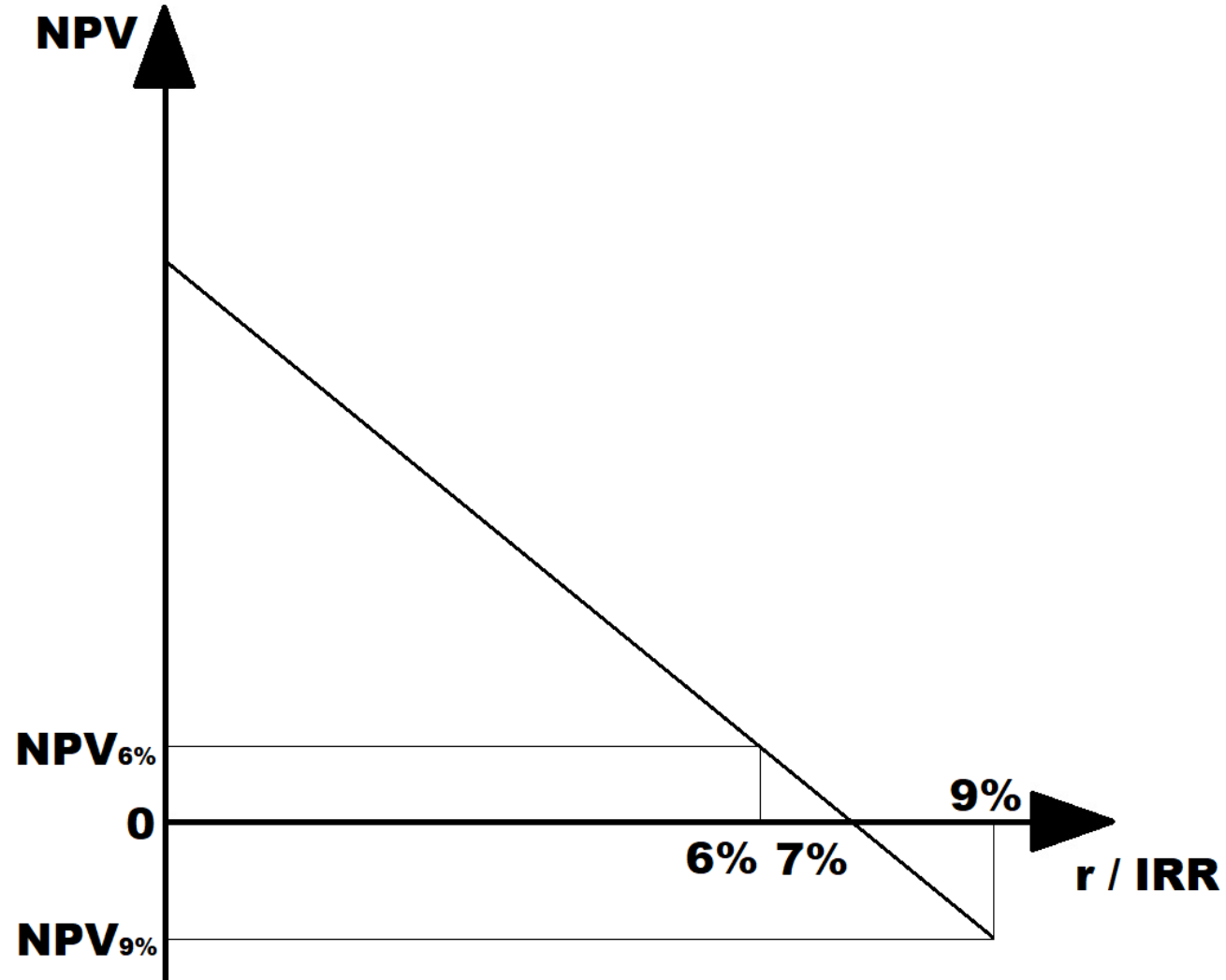
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IRR commentary



Please, remember, You have to paint a graph:

- **First**, You have to calculate IRR point on the horizontal axes.
- **Second**, You have to explore both NPV values in the graph.
- **Third**, You choose for the positive NPV.



Example PI



4. Assess the project by the profitability index when alternative costs are 8% p.a. .:

Cash flows (GBP)	Project A	Project B
C_0	- 100 000	-100 000
C_1	50 000	27 000
C_2	40 000	55 000
C_3	26 000	31 000

$$PI_A = \frac{\frac{50,000}{1.08^1} + \frac{40,000}{1.08^2} + \frac{26,000}{1.08^3}}{+100,000}$$

$$PI_B = \frac{\frac{27,000}{1.08^1} + \frac{55,000}{1.08^2} + \frac{31,000}{1.08^3}}{+100,000}$$

Payback Period Method (PBP)



Cash payback method (also called payback method) is a capital investment evaluation method that considers the cash flows as well as the cash payback period. Cash payback period is the expected period of time that will pass between the date of an investment and the full recovery in cash or equivalent of the amount invested.

The payback period method (PBP) is perhaps the most commonly used method in practice despite its undeniable considerable shortcomings. It is one of the most popular and simplest methods.

Payback period method is a very often used method which does not use discounted rate and time value of money. It tells the time in which an initial investment will be paid back. By modification of this method by use of time value of money respectively discounted rate the time period becomes longer.

$$\mathbf{PBP} = \frac{\text{Initial investment} - \text{the sum of the earliest initial investment}}{\frac{\text{CF after the last loaded values}}{12}}$$

PBP rule can be formulated in two ways:

- either a criterion is determined by the date by which the company requests the return of funds invested in the investment, and under this criterion any project may be selected;
- the project with the shortest payback is opted.

Payback Period Method – advantages and disadvantages



Advantage:

- Clear conclusions
- Simple opinions
- Easy evaluation

Disadvantages:

- This method does not take into account the timing of cash flows, so it is indifferent in which the particular year of the project flows, does not discount. *Reason:* The method does not take into account the time value of money.
- The method ignores cash flows after a critical date. *Reason:* PBP does not take into account all relevant cash flows, prefers "short-term" projects.
- When applying the NPV method investor through alternative costs incorporated into its calculation of market environment. When using PBP investor proceeds entirely "arbitrary" is not able to incorporate market influences

Discounted Payback Period Method – advantages and disadvantages



It corrects a lack of PBPs in that it first discounts cash flows and then examines the maturity.

Advantages:

- Takes into account the timing of CF
- Includes alternative costs (market factors)

Disadvantages :

- It does not take CF into account after a critical date
- Prefer short-term projects



Outline of the lecture



5. Consider whether the following 4-year project should be implemented when the cost of capital (discount rate) is 15%. Make a decision based on the Pay Back Period method. Find out the exact maturity. Use the discounted maturity option as well. Please comment on the results.

	C_0	C_1	C_2	C_3	C_4
Cash flows (EUR)	- 6 000	3 000	3 000	3 000	1 000

$$PBP_{project} = -6,000 + \frac{3,000}{1.15^1} + \frac{3,000}{1.15^2} + \frac{3,000}{1.15^3} + \frac{1,000}{1.15^4} = X$$

100% ??%

*months = X% * 12 = number.XY*

- You have to calculate the first positive value, then explore how much is X from the last calculation in percentages!

*days = X% * 30 = number.YZ*

Check questions



1. What is the time value of money? Why is it important to talk about it?
2. Which methods of investment valuation belong to the most popular?
3. Which method provides the most reliable results and why?
4. In what do the method of net present value and the method of internal rate of return differ? Describe the main reasons.
5. Describe the basic principles of individual methods of investment valuation and basic criteria for deciding on the acceptance of the project.



1. Examples from seminar 06.
2. ROSS, S. A., R. W. WESTERFIELD, J. JAFFE & B. D. JORDAN, 2019. Valuation and Capital Budgeting. In: Corporate Finance, PART II, pp. 85-298. ISBN 978-1-260-09187-8.
3. BERK, J. & P. DeMARZO, 2017. Valuing Projects and Firms. In: Corporate Finance, PART 3, pp. 244-308. ISBN 978-1-292-16016-0.



Thank you for
your attention!

