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FAKULTÄT II
FINANCE AND BANKING

Introduction to Corporate Finance: Making Capital Investment Decisions

Readings:

Hillier et al., Chapter 7.1, 7.3, 7.5

Overview of Lecture

- Incremental Cash Flows
- (Detailed Capital Budgeting Example)
- Inflation and Capital Budgeting
- (Alternative Definitions of Operating Cash Flow)
- Investments of Unequal Lives:
  The Equivalent Annual Cost Method

Incremental Cash Flows

Cash Flows

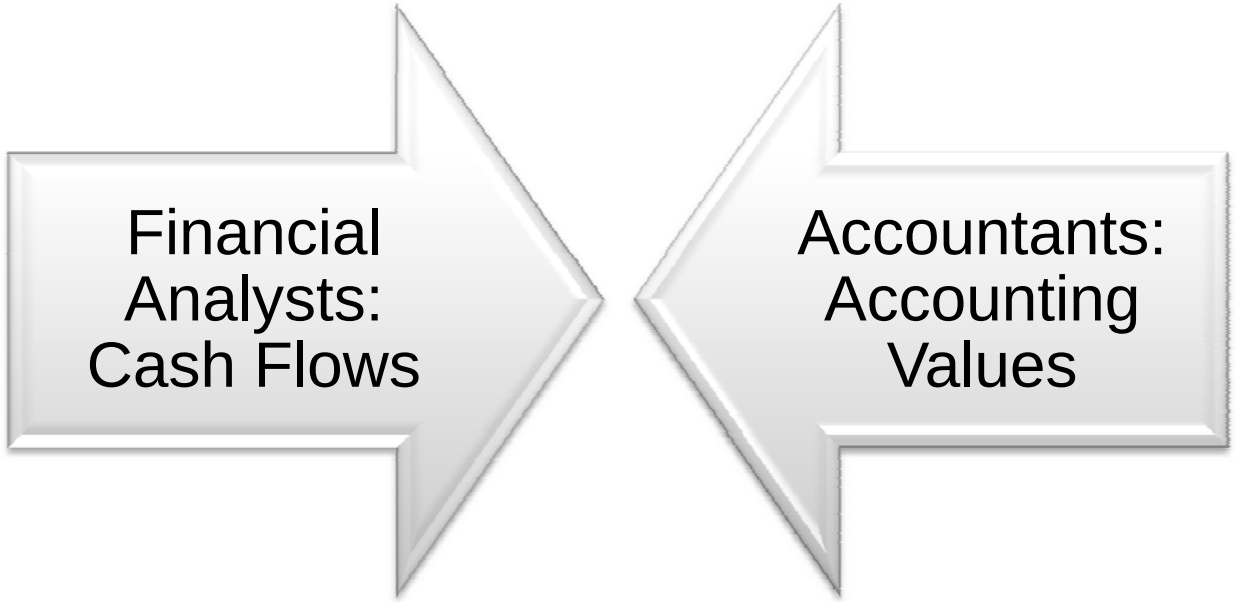
Sunk Costs

Opportunity Costs

Side Effects

Allocated Costs

Cash Flow or Accounting Income?



In capital budgeting,

- always use cash flows, and
- focus on incremental cash flows.

Example 7.1: Relevant Cash Flows

- Weber-Decker GmbH just paid €1 million in cash for a building as part of a new capital budgeting project. This entire €1 million is an immediate cash outflow.
- Assuming 20 percent reducing balance depreciation over 20 years, only €200,000 (=€1 million x 20 percent) is considered an accounting expense in the current year.
- Current earnings are thereby reduced by only €200,000. The remaining €800,000 is expensed over the following 19 years.
- For capital budgeting purposes, the relevant cash outflow at date 0 is the full €1 million, not the reduction in earnings of only €200,000.

Sunk Costs

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Definition

- A sunk cost is a cash flow that has already occurred

Rule

- Ignore all sunk costs

Example 7.2: Sunk Costs

- General Milk ltd is currently evaluating the NPV of establishing a line of chocolate milk. As part of the evaluation, the company had paid a consulting firm £100,000 to perform a test marketing analysis. The expenditure was made last year. Is this cost relevant for the capital budgeting decision now confronting the management of General Milk ltd?

Answer:
No. The £100,000 is already spent, and the decision to spend the money for the marketing analysis cannot be reversed. Thus, it is not relevant anymore for future decisions.

Opportunity Costs

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Definition

- Opportunity costs are lost revenues that you forego as a result of making the proposed investment

Rule

- Incorporate opportunity costs into your analysis

Example 7.3: Opportunity Costs

- Suppose Gonzales Trading has an empty warehouse in Salamanca that can be used to store a new line of electronic pinball machines. The company hopes to sell these machines to affluent European consumers. Should the warehouse be considered a cost in the decision to sell the machines?

Answer:
Yes. There could be alternative profitable uses for the warehouse. E.g., if it could be sold, the potential selling price would be an opportunity cost in the pinball machine investment decision.

Side Effects

Definition

- A side effect is classified as either **erosion** or **synergy**.
  - Erosion is when a new product reduces the cash flows of existing products.
  - Synergy occurs when a new project increases the cash flows of existing projects.

Rule

- Take into account all side effects of the investment

Example 7.4: Side Effects

- Suppose Innovative Motors (IM) is determining the NPV of a new convertible sports car. Some of the customers who would purchase the car are owners of IM's SUVs. Are all sales and profits from the new convertible sports car incremental?

Answer:
No. The project will erode sales in IM's SUV product line, which will have a negative effect on firm value. However, the project's NPV net of this erosion effect could still be positive.

Example 7.4: Side Effects

- IM is also contemplating the formation of a racing team. The team is forecast to lose money for the foreseeable future, with perhaps the best projection showing an NPV of –£35 million for the operation. However, IM's managers are aware that the team will likely generate great publicity for all of IM's products. A consultant estimates that the increase in cash flows elsewhere in the firm has a present value of £65 million. Should IM form the team?

Answer:
Yes (if the consultant's estimate seems reliable). The investment achieves a synergy and leads to a positive NPV of £30 million.

Allocated Costs

Definition

- An allocated cost is an accounting measure to reflect expenditure or an asset's use across the whole company

Rule

- Should be viewed as a cash outflow only if it is an incremental cost of the project.

Example 7.5: Allocated Costs

Voetmann Consulting NV devotes one wing of its suite of offices to a library requiring a cash outflow of €100,000 a year in upkeep. A proposed capital budgeting project is expected to generate revenue equal to 5 percent of the overall firm's sales. An executive at the firm, H. Sears, argues that €5,000 (=5 percent × €100,000) should be viewed as the proposed project's share of the library's costs. Is this appropriate for capital budgeting?

Answer:
No. The decision to accept or reject the project does not affect the annual cash flow spent on the library. These two investments are independent.

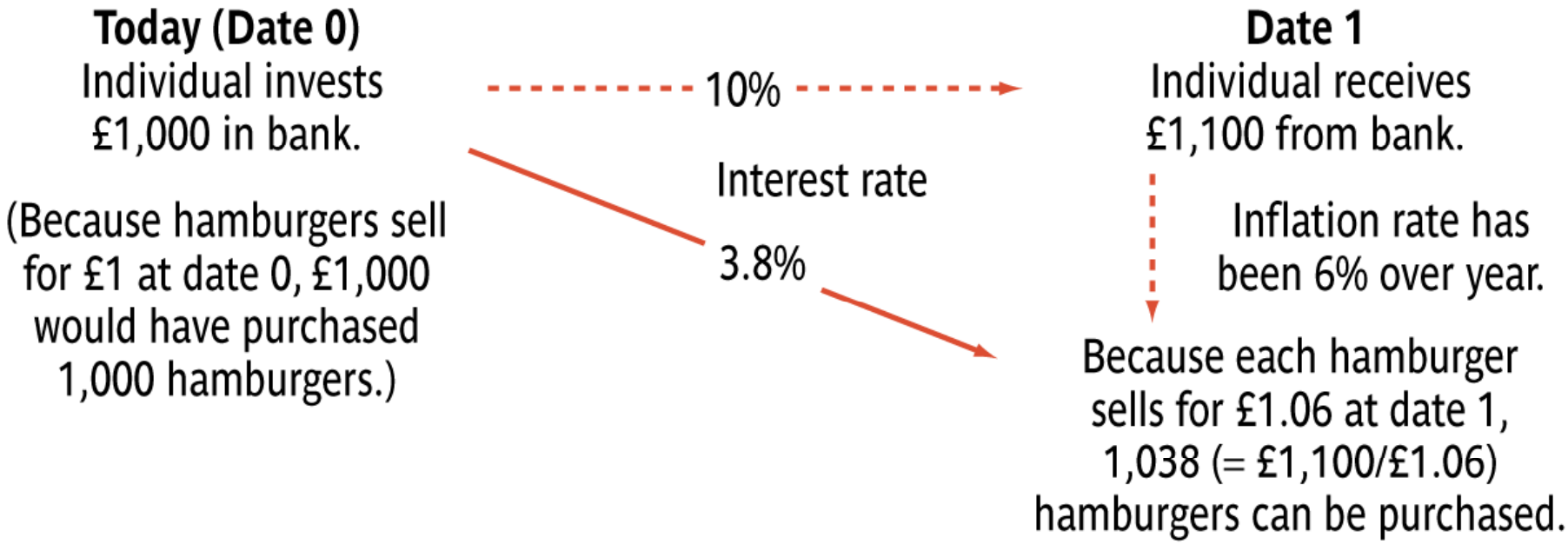
Inflation and Capital Budgeting

Interest Rates and Inflation

Cash Flow and Inflation

Discounting: Nominal or Real?

Interest Rates and Inflation



Hamburger is used as an illustrative good. 1,038 hamburgers can be purchased on date 1 instead of 1,000 hamburgers at date 0. Real interest rate = 1,038/1,000 – 1 = 3.8%.

Real and Nominal Interest Rates

$$r^{real} = \frac{1 + r^{nom}}{1 + inf} - 1$$

where r^{real} : real interest rate
r^{nom} : nominal interest rate
inf : inflation rate

Approximation: $r^{real} \cong r^{nom} - inf$

Real and Nominal Interest Rates Example

Nominal rate = 10%

Inflation rate = 6%

Real rate = ?

r^{real} = (1.10/1.06)-1

= 3.8%

$r^{real} \cong$ 10% - 6%

= 4%

Cash Flow and Inflation

Nominal Cash Flow

- The actual money in cash to be paid out or received

Real Cash Flow

- The purchasing power of the cash once inflation has been taken into account

Example 7.6: Nominal vs Real Cash Flow

- Burrows Publishing has just purchased the rights to the next book of famed romantic novelist Barbara Musk, which will be available to the public in 4 years. Currently, romantic novels sell for €10.00 in paperback. The publishers believe that inflation will be 6 percent a year over the next four years. Because romantic novels are so popular, the publishers anticipate that their prices will rise about 2 percent per year more than the inflation rate over the next four years. Burrows Publishing plans to sell the novel at €13.60 [$=(1.08)^4 \times$ €10.00] four years from now, anticipating sales of 100,000 copies.

- Is the cash flow in year 4 nominal or real?

Example 7.6: Nominal vs Real Cash Flow

- Answer: The cash flow is nominal.

- The real cash flow is: $\dfrac{€1.36\,\text{million}}{1.06^4} = €1.08\,\text{million}$

Discounting: Nominal or Real

General rule:

- Nominal cash flows should be discounted at the nominal rate
- Real cash flows should be discounted at the real rate

Example 7.7: Real and Nominal Discounting

- Consider the following project:

	0	1	2
Cash flow	–£1,000	£600	£650

- The nominal discount rate is 14 percent, and the inflation rate is forecast to be 5 percent. What is the value of the project?

- Discounting the nominal cash flows leads to:

$$£26.47 = -£1,000 + \frac{£600}{1.14} + \frac{£650}{(1.14)^2}$$

Example 7.7: Real and Nominal Discounting

- The real cash flows are:

	0	1	2
Cash flow	–£1,000	£571.43 (= £600/1.05)	£589.57 (= £650/1.05^2)

- Real discount rate: (1.14/1.05) – 1 = 8.57143%

- NPV: $£26.47 = -£1,000 + \frac{£571.43}{1.0857143} + \frac{£589.57}{(1.0857143)^2}$

⇨ I.e., both approaches lead to the same result

Example 7.8: Real and Nominal NPV

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	Year		
	0	**1**	**2**
Capital expenditure	€1,210		
Revenues (in real terms)		€1,900	€2,000
Cash expenses (in real terms)		950	1,000
Depreciation (straight-line)		605	605

Example 7.8: Real and Nominal NPV

- Inflation is 10 percent per year over the next two years.
- Cash flows of the project should be discounted at the nominal rate of 15.5 percent.
- Tax rate is 40 percent.

Example 7.8: Nominal and Real Cash Flows – Nominal Rate Analysis

	Year		
	0	**1**	**2**
Capital expenditure	–€1,210		
Revenues		€2,090 (= 1,900 × 1.10)	€2,420 [= 2,000 ×(1.10)^2]
–Expenses		–1,045 (= 950 × 1.10)	–1,210 [= 1,000 ×(1.10)^2]
–Depreciation		–605 (= 1,210/2)	–605
Taxable income		€ 440	€ 605
–Taxes (40%)		–176	–242
Income after taxes		€ 264	€ 363
+Depreciation		+605	+605
Cash flow		€ 869	€ 968

$$\text{NPV} = -€1,210 + \frac{€869}{1.155} + \frac{€968}{(1.155)^2} = €268$$

Example 7.8: Nominal and Real Cash Flows – Real Rate Analysis

	Year		
	0	**1**	**2**
Capital expenditure	–€1,210		
Revenues		€1,900	€ 2,000
–Expenses		–950	–1,000
–Depreciation		–550 (= 605/1.1)	–500 [= 605/(1.1)^2]
Taxable income		€ 400	€ 500
–Taxes (40%)		–160	–200
Income after taxes		€ 240	€ 300
+Depreciation		+550	+500
Cash flow		€ 790	€ 800

Real Rate: 1.155/1.10 – 1 = 5% ⇨ $NPV = -€1,210 + \frac{€790}{1.05} + \frac{€800}{(1.05)^2} = €268$

Investments of Unequal Lives: The Equivalent Annual Cost Method

- Two machines with the same revenues and the following costs:

	Date				
Machine	**0**	**1**	**2**	**3**	**4**
A	€500	€120	€120	€120	
B	€600	€100	€100	€100	€100

- Assuming a discount rate of 10%, NPV is:

$$\text{Machine } A\text{: } €798.42 = €500 + \frac{€120}{1.1} + \frac{€120}{(1.1)^2} + \frac{€120}{(1.1)^3}$$

$$\text{Machine } B\text{: } €916.99 = €600 + \frac{€100}{1.1} + \frac{€100}{(1.1)^2} + \frac{€100}{(1.1)^3} + \frac{€100}{(1.1)^4}$$

- What is problematic about this analysis?

Investments of Unequal Lives: The Equivalent Annual Cost Method

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Compare projects on a like-for-like basis

Calculate the equivalent annual cost of each project

Machine A	Machine B	Equivalent Annual Cost
• NPV = €798.42 • Life is 3 years	• NPV = €916.99 • Life is 4 years	• Calculate the equivalent annual cost of each machine

Investments of Unequal Lives: The Equivalent Annual Cost Method

- Machine A:

$$798.42 = C \cdot A^{3}_{0.10} = C \cdot \frac{1 - \frac{1}{(1+0.1)^{3}}}{0.1} = C \cdot 2.4869$$

$$\Rightarrow C = 321.05$$

	Date			
	0	**1**	**2**	**3**
Cash outflows of machine *A*	€500	€120	€120	€120
Equivalent annual cost of machine *A*		€321.05	€321.05	€321.05

Investments of Unequal Lives: The Equivalent Annual Cost Method

- Machine B:

$$916.99 = C \cdot A_{0.10}^{4} = C \cdot \frac{1 - \frac{1}{(1+0.1)^4}}{0.1} = C \cdot 3.1699$$

$$\Rightarrow C = 289.28$$

	Date				
	0	**1**	**2**	**3**	**4**
Cash outflows of machine *B*	€600	€100	€100	€100	€100
Equivalent annual cost of machine *B*		€289.28	€289.28	€289.28	€289.28

Investments of Unequal Lives: The Equivalent Annual Cost Method

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Choose Machine B

Example 7.9: Replacement Decisions

- Consider the situation of BIKE, which must decide whether to replace an existing machine. BIKE currently pays no taxes. The replacement machine costs £9,000 now and requires maintenance of £1,000 at the end of every year for eight years. At the end of eight years, the machine would be sold for £2,000 after taxes.

Example 7.9: Replacement Decisions

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- Cost schedule of existing machine:

Year	Maintenance	Aftertax Salvage
Present	£ 0	£4,000
1	1,000	2,500
2	2,000	1,500
3	3,000	1,000
4	4,000	0

- If BIKE faces an opportunity cost of capital of 15 percent, when should it replace the machine?

Example 7.9: Replacement Decisions

- Present value of the costs of the new machine:

$$PV_{costs} = 9{,}000 + 1{,}000 \cdot A_{0.15}^{8} - \frac{2{,}000}{1.15^{8}}$$

$$= 9{,}000 + 1000 \cdot \left(\frac{1 - \frac{1}{(1+0.15)^{8}}}{0.15} \right) - 2{,}000 \cdot 0.3269$$

$$= 9{,}000 + 1000 \cdot 4.4873 - 2{,}000 \cdot 0.3269$$

$$= 12{,}833$$

- Equivalent Annual Cost:

$$\frac{PV_{costs}}{A_{0.15}^{8}} = \frac{12{,}833}{4.4873} = 2{,}860$$

Example 7.9: Replacement Decisions

- If BIKE keeps the old machine for one year, maintenance costs = £1,000 a year from now.

- BIKE will receive £2,500 at date 1 if the old machine is kept for one year but would receive £4,000 today if the old machine were sold immediately.

- PV of the costs of keeping the machine one more year before selling it equals:

$$£4,000 + \frac{£1,000}{1.15} - \frac{£2,500}{1.15} = £2,696$$

Example 7.9: Replacement Decisions

Although we normally express cash flows in terms of present value, the analysis to come is easier if we express the cash flow in terms of its future value one year from now. This future value is:

£2,696 $\times$ 1.15 = £3,100

Example 7.9: Replacement Decisions

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	Year 1	Year 2	Year 3	Year 4	. . .
Expenses from replacing machine immediately	£2,860	£2,860	£2,860	£2,860	. . .

	Year 1	Year 2	Year 3	Year 4	. . .
Expenses from using old machine for one year and then replacing it	£3,100	£2,860	£2,860	£2,860	. . .

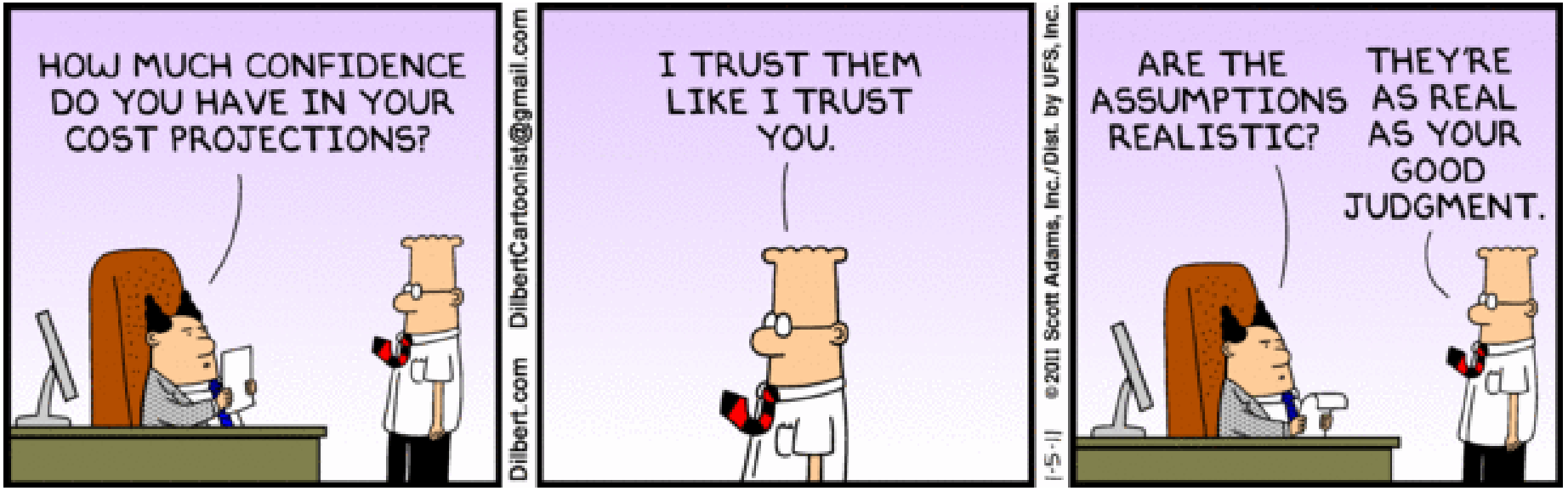
⇨ BIKE should replace the machine immediately

⇨ N.B.: To make sure that this is the right decision, we should also consider the alternatives of keeping the old machine for 2, 3, or 4 years. However, the respective calculations show that immediate replacement is still the best decision.

Overview of Lecture

- Incremental Cash Flows
- (Detailed Capital Budgeting Example)
- Inflation and Capital Budgeting
- (Alternative Definitions of Operating Cash Flow)
- Investments of Unequal Lives:
  The Equivalent Annual Cost Method

Finally…



In this introductory course, we focused on capital budgeting decisions made under **certainty**. The notion of **risk**, and how to deal with it, will be discussed in a later course called “Financial Management” (B.A. WIWI: SM 34 / B.A. BWL jur.: AS 17)