Introduction to Investment and Finance

Lars Wøldike Petersen



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LARS WØLDIKE PETERSEN

INTRODUCTION TO INVESTMENT AND FINANCE

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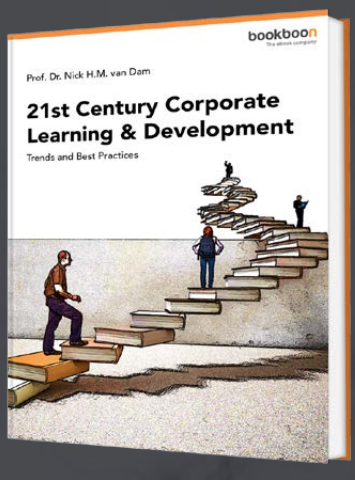
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PREFACE

GOAL OF THE BOOK

The overall goal of this book is to train and assist business students in carrying out investment and finance evaluations on an academic level.

We will make it our primary goal to train business students in avoiding accepting investments which are not profitable. We assume that most shareholders would appreciate this approach for their business managers.

Concerning finance, we will make it our primary goal to train business students in considering more than just the cost of financing. So many companies have suffered bankruptcy because they did not carefully consider the many other aspects of financing such as currency rates, interest rates and refinancing risks. We also assume that most shareholders would appreciate this approach for their business managers.

INVESTMENT AND FINANCE

In practical business life, investments and the finance of investments are very often closely connected. Business managers cannot carry out any investments without thinking about how to finance them. However even though investments cannot be carried out without finance, they are often not connected in such a way that investment and finance are linked together as a package.

Since this is the often the case, the company can shop around for the financing of its investments. The investment proposal does not normally involve a certain build-in finance case. The company can put together the financing interdependent of the investment. It can spread the finance over multiple financial sources such as bank and credit institutions, vendors and, of course, also by raising capital on the stock exchange. Sources are many and complex.

This being said, there are of course exceptions. Some finance sources are dependent on the investment at hand. Evaluating investments which include a specific build in finance package is however outside the scope of this book. In real life, the case could be that certain countries around the world offer export financing. In export financing, the finance and the investment are closely linked together.

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In this book, we choose to keep the investment and finance evaluation apart. This, however, leaves the discussion of what to look at first. Since most investments start as a necessity for the company, this will be considered first and then financing afterwards. One could argue that without financing there will be no investment. This is of course true – certainly the financial crisis showed us this. So, in some periods financing would have to be considered first while in other periods financing is plenty.

In this book investments will be considered first simply because there is no sense in pursuing financing for investments which are not profitable. They should be dropped immediately!

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1 INVESTMENT

1.1 INTRODUCTION TO INVESTMENT

When a company is considering starting a new business activity or continuing a business activity, it can be necessary to make "investments". In contrast to cash capacity costs (fixed costs), which are paid during the year when they are used in the company, investments are made once and paid and then used over a longer period. Investments are often said to be "multiple period costs".

An example of this can be seen below:

Example 1

> A company is considering buying a new machine at a price of 500.000. This machine is expected to be used for the next 5 years, after which it is expected to be sold for an amount of 30.000 (residual value). The earnings from the investment are expected to be 140.000 on an annual basis. The investment horizon is set at 5 years.

This investment, where 500.000 is tied up in the machine, has been made because it is expected to generate earnings during the next 5 years of 140.000 on an annual basis.

Had the machine not been purchased the amount of 500.000 could have been used for other purposes. The money could have been spent on financial investments like bonds and shares, which could have earned interest. Or if the company was going to take up a loan for the investment, it would have paid interest. That way the company can always find alternative investments for its money.

There is usually also a long time frame between making the investment and the inflow of earnings. Since there is a time gap between the cash outflow (the investment) and the cash inflow (earnings), the amounts cannot be compared to determine if the investment is profitable or not. Cash in different time periods cannot be compared since interest has to be taken into consideration.

The example below will illustrate this point:

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Example 2 – based on Example 1

Let us say that the investment in the new machine is paid by drawing the money from an overdraft account in a bank. This overdraft is a bit special since the bank does not charge any interest at all. The balance of the account is -500.000 right after the investment has been paid. Thus, the overdraft account is awaiting the deposit of the coming earnings of 140.000 annually.

Over the years the balance of the account will look as follows:

Year	Postings	Balance
0	-500.000,00	-500.000,00
1	140.000,00	-360.000,00
2	140.000,00	-220.000,00
3	140.000,00	-80.000,00
4	140.000,00	60.000,00
5	170.000,00	230.000,00

Table 1

The statement of account shows that at the end of the investment horizon the balance of the overdraft account will be 230.000. This clearly indicates that the investment is profitable. However, which bank would lend out any money without charging any interest? Probably none. Therefore, investment calculations have to take interest into consideration.

Now let us have a look of the same investment taking interest into consideration. We assume that the bank will charge the company a yearly interest of 15% p.a. on both negative and positive account balances.

Year	Begin balance	Postings	Interest base	Interest	End balance
0	0,00	-500.000,00	-500.000,00	-75.000,00	-575.000,00
1	-575.000,00	140.000,00	-435.000,00	-65.250,00	-500.250,00
2	-500.250,00	140.000,00	-360.250,00	-54.037,50	-414.287,50
3	-414.287,50	140.000,00	-274.287,50	-41.143,13	-315.430,63
4	-315.430,63	140.000,00	-175.430,63	-26.314,59	-201.745,22
5	-201.745,22	170.000,00	-31.745,22	-4.761,78	-36.507,00

Table 2

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The result of taking interest into consideration during evaluation of this investment is that the investment is not profitable. The statement of account shows that at the end of the investment horizon the balance of the overdraft account will be -36.507. A negative balance of account.

Therefore, to avoid taking on investments which are not profitable, interest should always be included.

This can be done by making an investment calculation. In the following, each period (normally a year) will be called a period.

1.2 CONCLUSION

An investment is made when money is tied up in an asset with the purpose of generating future earnings or savings over multiple periods. Because of the time involved (often several years), the company needs to consider the potential interest which alternative investments could earn or the interest that will have to be paid on a loan (like the example given above).



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2 INVESTMENT ASSUMPTIONS

2.1 INTRODUCTION

There are multiple ways of evaluating a potential investment. The important thing about investment decisions is of course not to accept investments, which are not profitable. In Chapter 1 we saw how a wrong investment evaluation could potentially lead to bad investment decision. A wrong decision, which would lead to a loss rather than a profit for the company.

Before we turn to the actual investment evaluation we need to lay down the basic assumptions. The assumptions must all be met when preparing an investment calculation – no matter which method is used.

The following sections will lay down the key assumptions for any investment evaluation.

2.2 TIME OF INVESTMENT AND START OF BUSINESS

Throughout this book we will assume that the investment is paid in Period 0. The logic of this is that the investment has to be installed and ready for use before the actual business operations start in Period 1. Together with the investment any initial start up costs relating to the investment are also assumed paid in Period 0.

If the investment is not paid upon delivery but, later, because the company has been offered favorable credit terms, then the payment of the investment should be included in the periods in which they are actually paid.

Also, throughout this book, we will assume that the business operations will start in Period 1. Here, we define business operations as the activities creating operational cash flow. This does not include any investment or start-up costs related to the investment.

2.3 CASH EARNINGS

In connection with investment calculations, earnings are always the cash result before depreciation. This means that the accounting result before depreciations must be converted into a cash result before depreciations. If there are no extra cash capacity costs, the company can use the cash contribution margin. But still, the company should use cash contribution margin instead of accounting contribution margin. The difference between accounting result and cash result is that the accounting result is subject to what is often referred to as accrual accounting.

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In accrual accounting, sales can be recognized as sales in the income statement even though they have not yet been paid by the customer. Of course, this is also the case with costs. Costs can be recognized as costs in the income statement even though they have not yet been paid or were actually paid in a previous period.

Thus, accounting earnings are often a poor substitute for actual cash flow.

To illustrate this point see the example below:

Example 3

A company has recognized 100.000 as sales in the income statement and cost of goods sold of 80.000 resulting in an accounting contribution margin of 20.000. If the sales and the costs were all settled in cash, then the cash result for the year would be 20.000. However, this is not the case since 30.000 of the 100.000 in sales have not yet been paid to the company by the customers.

Furthermore, the company has not yet paid all of the recognized costs. Thus, 10.000 of the 80.000 recognized costs have not been paid by the company to its suppliers.

Below, the accounting contribution margin is converted into a cash contribution:

Accounting contribution			20.000,00
	Begin	End	
Change in trade debtors	0,00	30.000,00	-30.000,00
Change in trade creditors	0,00	10.000,00	10.000,00
Cash contribution margin			0,00

Table 3

As can be seen from the example above, accounting earnings do not necessarily result in the same cash earnings. Cash can be tied up in trade debtors and set free from trade creditors. Thus, accounting earnings are often a poor substitute for cash earnings.

Unless otherwise stated in this book we will assume sales and costs to be settled in cash.

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Now, why is it that accounting earnings cannot be used in evaluating an investment decision? Well, looking back at our initial Example 2 in Chapter 1 we used an overdraft account as the method of evaluation. Drawings from and deposits to an overdraft account are usually cash and not accounting earnings.

This is the reason for using cash earnings in investment evaluations and not accounting earnings.

2.4 CASH INVESTMENTS

As with earnings the investment must also be quoted in cash when preparing investment evaluations. Thus, accrual accounting methods of recognizing investments in the income statement, such as depreciations and impairment, are not cash.

Postponed payment of the investment should be treated in accordance with Section 2.1 as above.



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2.5 TAXES

Payable taxes must also be included in the investment evaluation if the investment is subject to any kind of payable tax. In a later chapter of this book we will look into how to calculate and include payable taxes in the investment evaluation. Deferred taxes can, however, never be included in the investment evaluation since these taxes are yet another result of accrual accounting.

2.6 INTEREST AMOUNTS

Interest amounts from financing the investment under consideration are not included as an amount in the investment evaluation. The financing amounts are included in the evaluation by using interest calculations.

As explained earlier, cash flow in different periods cannot be compared. The interest rate used is called the discount rate and include both payment for waiting and risk associated with the investment.

2.7 RELEVANT AMOUNTS

Only amounts relevant to the investments should be included in the investment evaluation. This sounds very logical but can in fact be very confusing.

The example below illustrates this point:

Example 4

> A company is considering investing in a new machine for a new business activity. The place in the factory where the machine will be installed has a leaking roof. The repair of the leaking roof will cost 100.000.
>
> The question is whether the cost of the roof repair should be included in the investment evaluation or not. In this case, the repair will probably be carried out anyway, and therefore, it is of no relevance to the investment evaluation.
>
> Furthermore, the floor on which the machine will be installed needs to be reinforced with new concrete to withstand the machine. This will cost 200.000. Now, since the cost of concrete reinforcement will only the paid if the investment is carried out, the amount needs to be included in the investment evaluation.

Thus, only amounts occurring from the decision to invest should be included in the investment evaluation.

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2.8 NONE COMMITTED AMOUNTS

Only none committed amounts can be included in the investment evaluation.

"Committed" means that the company has acted in such a way that the amount (usually a cost) cannot be avoided.

The reason could be that the amount has already been paid or the company has promised to pay the amount. Since the amount is already committed the company can no longer influence this amount. Thus the amount should not be considered in the investment evaluation.

The only exception to this is when the amount is recoverable. Then the amount should be included.

Usually companies carry our market surveys before they decide to invest in a new business activity. The costs of such market surveys should not be included in the later investment evaluation since they are committed costs. Committed costs are often also known as sunk costs.

The example below illustrates the points above:

Example 5

> A pharmaceutical company has undertaken a market survey for a new drug. The market research has shown that the drug will be a huge success if it is marketed. The market survey cost the company 10.000.000 while it is projected that the marketing will cost the company 20.000.000 annually over a 5-year period. The company is now considering developing the drug for the market.
>
> In this case the amount paid for the market survey is a committed cost and should thus not be included in an investment evaluation. No matter what the company does it can no longer change its decision about carrying out the market survey and thus avoid the cost. The cost of the market survey is thus no longer of importance to the decision about future investments.
>
> The projected marketing of the drug is, however, an uncommitted cost, because the decision to carry out the marketing has not yet been taken (committed). Thus, the marketing of the drug should be included in the investment evaluation.

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2.9 OPPORTUNITY AMOUNTS

Opportunity amounts must be included in the investment evaluation if other activities are affected by the investment under consideration.

The example below illustrates this point:

Example 6

A company is considering a new investment project. The project will launch a brand new product to the market. The new product cannot be produced within the existing capacity of the company. In order to actually produce the new product, the company will have to reduce production of other products. This will lead to a loss in sales (and therefore also contribution). Therefore, going ahead with the investment project causes a loss of contribution from other products.

Going ahead with the investment means that the company would have to give up contribution from other products. The loss of contribution relating to this is an opportunity amount and must be included in the investment evaluation of the new product.

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Concerning investments which are mutually exclusive (and thus competing), the investment evaluation should be carried out independently. Thus, the investment evaluation of the investment should not include foregone profit from the competing investments.

The reason for this is that the profitability of investment which is mutually exclusive (and thus competing) can be evaluated independently using the net present value method.

"Mutually exclusive" means that the company does not have the intention to go through with both investment opportunities. Thus, one of the opportunities at hand must be dropped in order to go through with the other.

2.10 MARGINAL AMOUNTS

Only the marginal effect caused by the investment can be included in the investment evaluation. This means that only the extra earnings caused by this investment being considered can be included in the investment evaluation. Thus, the earnings from activities that the company is already engaged in are not to be included. They are irrelevant and cannot be used to pay back the investment being considered.

2.11 DISCOUNT RATE

The interest rate used in the investment calculation is often referred to as the discount rate. The discount rate must include payment for waiting and for worrying (risk).

2.12 INVESTMENT HORIZON

In the evaluation of investment, the horizon needs to be defined. For the profitability of the investment to be calculated, a beginning and an end of the investment is set. At the beginning of the horizon the investment is made.

At the end of the investment horizon, the same investment is evaluated causing no residual value, a positive residual value or a negative residual value. It is the underlying assumption that the investment is disposed or sold to mark an end of the investment. A residual value is positive when the investment (e.g. a machine) can be sold, and, negative when the disposal and clean-up costs exceed the sale of the investment. Both are assumed settled at the end of the investment horizon.

In real-life, investments are often ongoing with no set end date. However, in evaluating the investment profitability an end is needed. Otherwise, the profitability cannot be measured.

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3 INVESTMENT EVALUATION METHODS

In this chapter we use the following investment example to explain the different investment evaluation methods.

Consider the following example:

Example 7

A company is considering investing in a new business activity. If it goes ahead, it needs to invest in a machine with a price of 400.000 and a reselling price (residual value) after 10 years of 20.000. The company uses a discount rate of 10% p.a. in evaluating investment decisions.

The expected earnings (cash result before depreciation) for the coming 10 periods (years) can be seen below:

Period	Earnings
1	40.000,00
2	45.000,00
3	50.000,00
4	55.000,00
5	60.000,00
6	65.000,00
7	70.000,00
8	75.000,00
9	80.000,00
10	85.000,00

Table 4

3.1 THE NET PRESENT VALUE METHOD

Using the net present value we compare the investment with earnings (cash result before depreciation) resulting from the investment.

Normally, the investment is made and paid at the beginning of the period – in Period 0. Reinvestments in other periods can also occur and they should, of course, be included.

In principle, all figures can be dated to any period and be compared. "Dated" means that the evaluated amounts are discounted to the relevant period, usually Period 0 (zero). Under the net present value method all figures are dated to Period 0 (zero).

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If the net present value is positive or 0 (zero) the investment is profitable.

We can prepare an investment calculation for the considered new business activity mentioned before:

Period	Investment	Earnings	Net cash flow
0	-400.000,00		-400.000,00
1		40.000,00	40.000,00
2		45.000,00	45.000,00
3		50.000,00	50.000,00
4		55.000,00	55.000,00
5		60.000,00	60.000,00
6		65.000,00	65.000,00
7		70.000,00	70.000,00
8		75.000,00	75.000,00
9		80.000,00	80.000,00
10	20.000,00	85.000,00	105.000,00
	Net present value		-32.049,74

Table 5



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The "NPV" formula in Excel is used for the calculation of the net present value. This formula can discount different figures in different periods back to Year 0 (zero).

By using the net present value method all future earnings, savings and residual value (and investments if any besides the first in Year 0) must be discounted back to Period 0 (zero) by using the discount rate. If the net present value is positive or 0 (zero) the investment is profitable.

If the net present value is negative, the investment is not profitable at an interest (discount rate) of 10% p.a.

Thus the company should not go ahead with the investment.

3.2 INTERNAL RATE OF RETURN METHOD

By reducing the interest and making new calculations the company can find the interest rate which gives a net present value of 0. This interest rate makes the investment only just profitable and is called the Internal Rate of Return (IRR).

Period	Investment	Earnings	Net cash flow
0	-400.000,00		-400.000,00
1		40.000,00	40.000,00
2		45.000,00	45.000,00
3		50.000,00	50.000,00
4		55.000,00	55.000,00
5		60.000,00	60.000,00
6		65.000,00	65.000,00
7		70.000,00	70.000,00
8		75.000,00	75.000,00
9		80.000,00	80.000,00
10	20.000,00	85.000,00	105.000,00
	Internal rate of return		8,3591445%

Table 6

Under the internal rate of return method, the decision rule is to only accept investments where the internal rate of return is equal to or higher than the discount rate. Since this is not the case in this example, the investment should not be carried out by the company, i.e. it should be rejected.

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The "IRR" formula in Excel is used for the calculation of the internal rate of return. This formula can calculate the discount rate which earns the investment a net present value of just zero.

Entering the internal rate of return in the calculation from the net present value method proves this point:

Period	Investment	Earnings	Net cash flow
0	-400.000,00		-400.000,00
1		40.000,00	40.000,00
2		45.000,00	45.000,00
3		50.000,00	50.000,00
4		55.000,00	55.000,00
5		60.000,00	60.000,00
6		65.000,00	65.000,00
7		70.000,00	70.000,00
8		75.000,00	75.000,00
9		80.000,00	80.000,00
10	20.000,00	85.000,00	105.000,00
	Net present value		0,00

Table 7

3.3 THE ANNUITY METHOD

By using the annuity method, the investment and residual value are distributed over the investment horizon. This distributed amount is sometimes referred to as the capital service amount. The capital service amount can be thought of as accounting depreciations including interest.

The annuity method should only be used if the period's earnings are the same in each period.

If the capital service amount is smaller than the earnings or savings in each year, the investment is profitable and should thus be carried out. Subtracting the capital service amount from the earnings is called economic profit.

Example 8

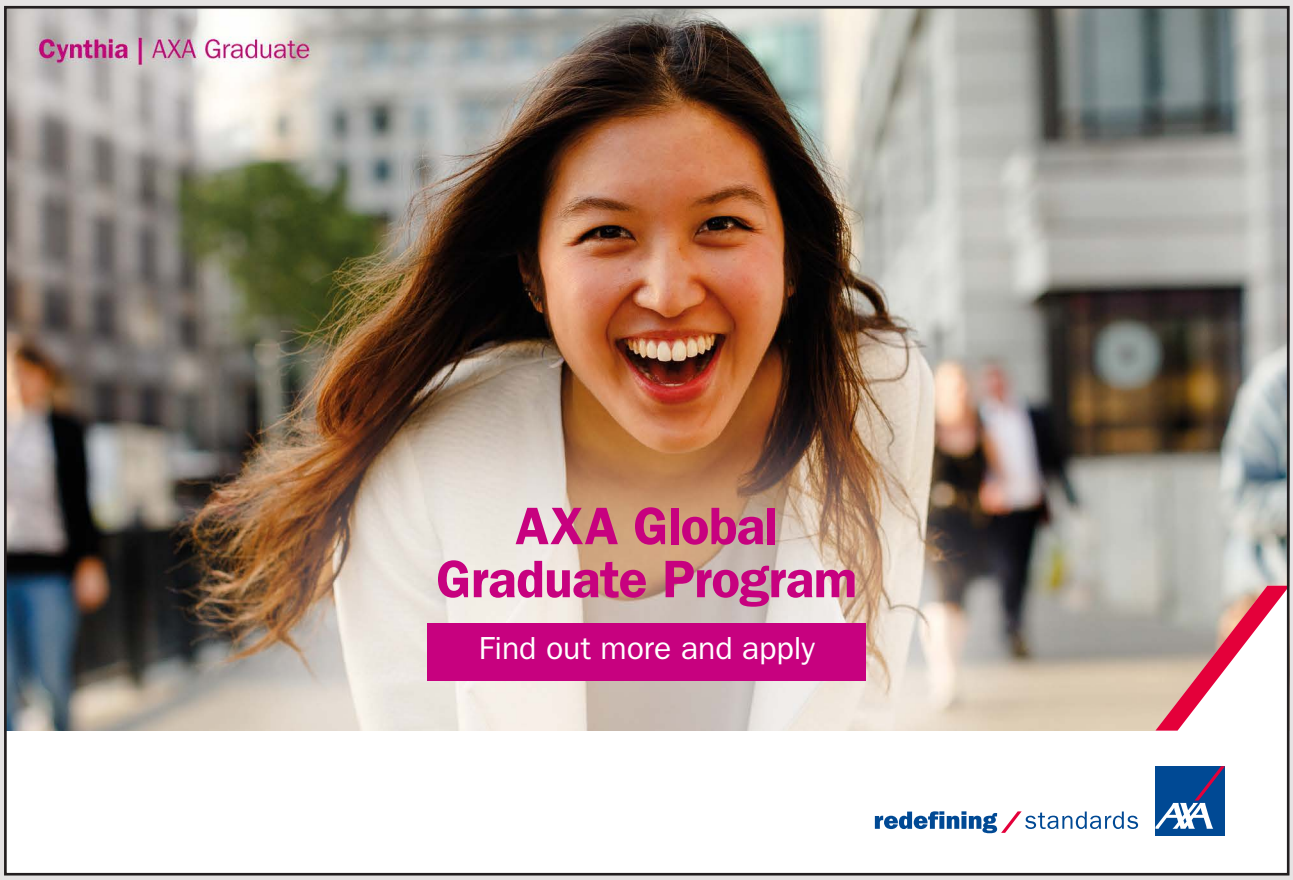
> As the previous example does not involve earnings which are the same in every period the expected earnings are changed. The earnings per period for all 10 years are set to 50.000. The investment, residual value and discount rate remain unchanged.

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Calculation of economic profit	
Investment	-400.000,00
Residual value	20.000,00
Number of periods	10
Dicount rate	10%
Capital service amount	63.843,25
Earnings	50.000,00
Capital service amount	63.843,25
Economic profit	-13.843,25

Table 8

The "PMT" formula in Excel is used for the calculation of the capital service amount. This formula can convert the investment and the residual value into an annuity per period over 10 periods in total. The calculated capital service amount of 63.843,25 is an annual cost to the company. Note that Excel returns the figure as a positive amount even though the amount represents a cost. Thus, the sign should be ignored.



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The decision rule under the annuity method is only to accept investments where the economic earnings are equal to or greater than the capital service amount. Or put another way, the economic profit should be equal to 0 (zero) or positive. Since this is not the case, the investment being considered should be rejected.

3.4 THE PAY-BACK METHOD

The pay-back method can be used as a supplement to one of the other methods, if you want to find out how fast the investment is repaid. The calculation of the pay-back period can be done either by excluding interest or including interest. In general, the calculation should always include interest as amounts in different periods cannot be compared without it. However, here we will start off by calculating the pay-back period excluding interest.

Consider the example below:

Example 9

A company is considering investing in a new business activity. If it goes ahead it needs to invest in a machine with a price of 300.000 and a reselling price (residual value) after 5 years of 30.000. The company uses a discount rate of 10% p.a. in evaluating investment decisions.

The expected earnings (result before depreciation) in the coming 5 periods (years) can be seen below:

Period	Earnings
1	50.000,00
2	100.000,00
3	150.000,00
4	50.000,00
5	20.000,00

Table 9

The way to calculate the pay-back period excluding interest is simply to calculate the accumulated balance of the investment at the end of each period.

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When the balance is 0 (zero) or positive the pay-back period is found. The result can be seen below:

Calculation of the pay-back period excluding interest

Period	Investment	Earnings	Net cash flow	Accumulated balance
0	-300.000,00		-300.000,00	-300.000,00
1		50.000,00	50.000,00	-250.000,00
2		100.000,00	100.000,00	-150.000,00
3		150.000,00	150.000,00	0,00
4		50.000,00	50.000,00	50.000,00
5	30.000,00	40.000,00	70.000,00	120.000,00

Table 10

The accumulated balance becomes 0 (zero) in Period 3, which is then the pay-back period.

The same calculation can now be prepared including interest. When the present value of the future earnings covers the investment, the investment has been paid back. The way to calculate the pay-back period including interest is simply to calculate the accumulated balance of the investment at the end of each period, but now using the present value of the cash flow from each period. When the balance is 0 (zero) or positive the pay-back period is found.

The result can be seen below:

Calculation of the pay-back period including interest

Period	Investment	Earnings	Net cash flow	PV of net cash flow	Accumulated balance
0	-300.000,00		-300.000,00	-300.000,00	-300.000,00
1		50.000,00	50.000,00	45.454,55	-254.545,45
2		100.000,00	100.000,00	82.644,63	-171.900,83
3		150.000,00	150.000,00	112.697,22	-59.203,61
4		50.000,00	50.000,00	34.150,67	-25.052,93
5	30.000,00	40.000,00	70.000,00	43.464,49	18.411,56

Table 11

Taking interest into consideration, this extends the pay-back period from 3 years to sometime in Year 5. This means that calculating the pay-back period excluding interest will understate the pay-back period. Thus, it should not be used even though it is easy to both calculate and understand.

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The example above is used when the earnings are not annuities. When earnings are an annuity the pay-back time is very simple to calculate including interest. An example of this is given below:

Example 10

A company is considering investing in a new business activity. If it goes ahead it will need to invest in a machine with a price of 500.000 and a reselling price (residual value) after 5 years of 50.000. The annual earnings have been estimated to 120.000. The company uses a discount rate of 8% p.a. in evaluating investment decisions.

Calculation of the pay-back period including interest	
Using NPER in excel:	
i	0,08
pmt	120.000,00
pv	-500.000,00
fv	50.000,00
Nper =	4,83

Table 12

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The pay-back period is sometime in Year 5.

A warning in connection with the general use of the pay-back method is appropriate here. Investments with a shorter pay-back period are not necessarily more profitable or "safe" than investments with longer pay back periods.

Thus, investments with shorter pay-back periods should not be chosen over investments with longer pay-back periods. The choice between two or more competing projects should only be made on the basis of the net present value method.

This is, of course, seen from an economic point of view. Some corporations may, for some reason, only have a mandate to engage in investments with shorter pay-back periods. This may cause these companies to choose less profitable investments over more profitable investments just to comply with the company rules. Thus, the company is destroying value on behalf of their shareholders instead of creating it.

The example below will illustrate this point.

Example 11

A company is considering two investments:

1. A 7-period investment of 600.000 with a residual value of 50.000. The investment will earn the company 130.000 per period.
2. A 5-period investment of 500.000 with a residual value of 50.000. The investment will earn the company 120.000 per period.

Both investments are subject to the same risk and, thus, use the same discount rate of 5% p.a.

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Pay-back period and net present value for two investments

Using NPER in excel:	
i	0,05
pmt	130.000,00
pv	-600.000,00
fv	50.000,00
Nper =	4,98

Using NPER in excel:	
i	0,05
pmt	120.000,00
pv	-500.000,00
fv	50.000,00
Nper =	4,36

Net present value using NPV in excel:

Period	Investment	Earnings	Net cash flow
0	-600.000,00		-600.000,00
1		130.000,00	130.000,00
2		130.000,00	130.000,00
3		130.000,00	130.000,00
4		130.000,00	130.000,00
5		130.000,00	130.000,00
6		130.000,00	130.000,00
7	50.000,00	130.000,00	180.000,00
	Net present value =		187.762,61

Period	Investment	Earnings	Net cash flow
0	-500.000,00		-500.000,00
1		130.000,00	130.000,00
2		130.000,00	130.000,00
3		130.000,00	130.000,00
4		130.000,00	130.000,00
5	50.000,00	130.000,00	180.000,00
	Net present value =		102.008,28

Table 13

The first investment opportunity has a pay-back period of 4,98 against 4,36 for the second investment opportunity. Choosing the investment with the shortest pay-back period (the second investment opportunity) will, however, mean giving up a net present value of (187.762,61 – 102.008,28) = 85.754,33. This is surely not in the interest of the shareholders.

Thus, the first investment opportunity should be chosen even though the pay-back period is longer. This is because the net present value of the first investment opportunity is higher than the second investment opportunity.

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4 INVESTMENT MOTIVES

Evaluating an investment opportunity means that the financial consequences of going through with the investment have to be quantified. The investment itself needs to be budgeted (including residual value) as well as future earnings. Otherwise, the investment evaluation cannot be prepared. For a thorough review of budgeting see Glenn A. Welsch and more "Budgeting – Profit planning and control".

It is important that only the marginal effects of the investments are included in the quantification of the financial consequences.

Until now we have only considered investments which bring in earnings. However, companies often also make investments in order to rationalize (save costs). In these cases, it is the cost savings which repay the investment. Thus, the earnings included in the investment evaluation should be the saved costs caused by the investment.



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Companies have different motives behind their investments. Below are 3 different motives:

- Investment in additional capacity
- Investment in a new project
- Rationalization investments

We will address these three situations in the following sections.

4.1 INVESTMENT IN ADDITIONAL CAPACITY

The motive behind this type of investment is usually to expand the production capacity in order to increase earnings within an existing business activity. Thus, it is just business as usual but with a larger capacity. One of the assumptions behind this situation could be to acquire more of an existing market by assuming a larger market share or simply, just trying to keep up with a growing market.

When calculating the expected change in earnings the following elements can be used in calculating the marginal expected effect of the investment:

Marginal expected effect of the investment	**Calculation**
Expected change in turnover	Expected change in number of units sold x sales price
- Expected change in variable costs	Expected change in number of units sold x variable costs per unit
= Expected change in contribution margin	Expected change in number of units sold x contribution margin per unit
- Expected change in sales promotion costs	Expected change in sales promotion costs
= Expected change in marketing margin	
- Expected change in cash capacity costs	Expected change in cash capacity costs
= Expected change earnings	

Table 14

The expected change in the elements above can be quantified by budgeting the total number expected after the investment in additional capacity less the current total.

The example below illustrates the investment in additional capacity:

Example 12

A hostel is considering expanding the capacity from 50 rooms to 75 rooms. For the existing 50 rooms the budget has been prepared for the coming year:

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Income statement budget			
Sales			6.000.000,00
Variable costs	Cleaning of rooms	-450.000,00	
	Supplies used in the restaurant	-600.000,00	-1.050.000,00
Contribution			4.950.000,00
Cash capacity costs			
	Sales promotion costs	-350.000,00	
	Rent, heat ect.	-1.200.000,00	
	Wages	-1.900.000,00	
	Other	-600.000,00	-4.050.000,00
Earnings			**900.000,00**

Table 15

The expansion of the hostel is expected to amount to:

Investment in expansion:	
Expansion of exsisting building	2.500.000,00
Extra equipment	1.000.000,00
Total investment in expansion	**3.500.000,00**

Table 16

For the expansion of the hostel to be profitable the marginal earnings from the expansion must cover the investment of 3.500.000.

In order to calculate the marginal effects on earnings caused by the expansion a new budget is prepared. The new budget includes the total budget including the additional 25 rooms.

If the expansion is profitable, the net earnings created by the expansion must cover the costs of the extension. The new budget and calculated marginal effect on earnings can be found below:

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Income statement budget	Before	After	Marginal effect
Sales	6.000.000,00	8.750.000,00	2.750.000,00
Variable costs			
Cleaning of rooms	-450.000,00	-700.000,00	-250.000,00
Supplies used in the restaurant	-600.000,00	-1.000.000,00	-400.000,00
Contribution	4.950.000,00	7.050.000,00	2.100.000,00
Cash capacity costs			
Sales promotion costs	-350.000,00	-600.000,00	-250.000,00
Rent, heat ect.	-1.200.000,00	-1.600.000,00	-400.000,00
Wages	-1.900.000,00	-2.600.000,00	-700.000,00
Other	-600.000,00	-800.000,00	-200.000,00
Earnings	**900.000,00**	**1.450.000,00**	**550.000,00**

Table 17

Since the net effect on earnings is expected to be 550.000, this is the amount which should be used in the investment evaluation. The effect in earnings is expected to remain unchanged throughout the investment horizon. The investment horizon is set at 12 years and the discount rate at 12% p.a. The residual value is expected to be 1.000.000.



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Calculation of the net present value using NPV in excel:			
Period	Investment	Marginal earnings	Net cash flow
0	-3.500.000,00		-3.500.000,00
1		550.000,00	550.000,00
2		550.000,00	550.000,00
3		550.000,00	550.000,00
4		550.000,00	550.000,00
5		550.000,00	550.000,00
6		550.000,00	550.000,00
7		550.000,00	550.000,00
8		550.000,00	550.000,00
9		550.000,00	550.000,00
10		550.000,00	550.000,00
11		550.000,00	550.000,00
12	1.000.000,00	550.000,00	1.550.000,00
	Net present value =		163.580,92

Table 18

Since the net present value is positive the investment is profitable and should be accepted. The investment could of course also be evaluated using either the internal rate of return method or annuity method. The conclusion on the investment considered would of course be exactly the same.

4.2 INVESTMENT IN A NEW PROJECT

The motive behind this type of investment is usually to start a new activity within an existing business such as a new line of products etc. Or start an entirely new business. Both types of motives often involve investment before the activity or new business can be started. One of the assumptions behind this situation is of course to expand into new markets for the business. It is the earnings from the new activity which must repay the investment in the new activity. Thus, the earnings of the new activity need to be budgeted.

When calculating the expected marginal earnings from the investment, the following elements can be used:

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Expected effect from the investment	Calculation
Expected turnover	Expected number of units sold x sales price
- Expected variable costs	Expected number of units sold x variable costs per unit
= Expected contribution margin	Expected number of units sold x contribution margin per unit
- Expected in sales promotion costs	Expected sales promotion costs
= Expected marketing margin	
- Expected cash capacity costs	Expected cash capacity costs
= Expected earnings	

Table 19

The example below illustrates the investment in a new project:

Example 13

The local tourist board in a city is considering to invest in a train which can take tourists around the streets of the city. The price of the train is 300.000 while the residual value of the train is expected to be 100.000. The investment horizon is 5 years and the discount rate is 10% p.a.

Income statement budget:

Period	No. Of tourists	Price per tourist	Turnover	Capacity costs	Earnings
1	12.000,00	8,00	96.000,00	-62.000,00	34.000,00
2	14.000,00	8,00	112.000,00	-62.000,00	50.000,00
3	14.000,00	9,60	134.400,00	-62.000,00	72.400,00
4	15.000,00	9,60	144.000,00	-62.000,00	82.000,00
5	16.000,00	9,60	153.600,00	-62.000,00	91.600,00

Table 20

With the assumptions given above, the profitability of the investment can now be calculated using the net present value method:

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Calculation of the net present value using NPV in excel:			
Period	Investment	Marginal earnings	Net cash flow
0	-300.000,00		-300.000,00
1		34.000,00	34.000,00
2		50.000,00	50.000,00
3		72.400,00	72.400,00
4		82.000,00	82.000,00
5	100.000,00	91.600,00	191.600,00
	Net present value =		1.602,23

Table 21

Since the net present value is positive, the investment is profitable and should be initiated.

The investment could, of course, also be evaluated using either the internal rate of return method or annuity method. The conclusion on the investment considered would, of course, be exactly the same.



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4.3 RATIONALIZATION INVESTMENTS

The motive behind this type of investment is usually to cut costs in existing activities. It is thus the cost savings, which should repay the investment. Here, the cost savings are the earnings we have used so far. Cost savings can be many things. For example, lower cost of goods sold, lower waste, lower energy consumption, lower wages and salaries. In order to calculate the profitability of the investment the cost savings must be budgeted.

When calculating the expected cost savings (=earnings) for rationalization purposes the following elements can be used in calculating the expected marginal effects from the investment:

Expected cost saving from the investment	Calculation
Change in variable costs	Expected number of units sold x change in variable costs per unit
= Change in contribution margin	Expected number of units sold x change in contribution margin per unit
= Change in marketing margin Change in cash capacity costs	Expected change in cash capacity costs
= Change in earnings	

Table 22

Please note that the items above read "change". This is because a rationalization investment might also cause cost increases, even though the purpose of the investment is to save costs.

An example of this could be investment in automation to cut salaries. The salaries would decrease but since the consumption of electricity will also increase because of the automation, then so will the costs of this.

Both changes, of course, have to be included in the evaluation of the investment.

The example below illustrates a rationalization investment:

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Example 14

A company is considering investing in an automatic web based ticket system to substitute personal service. This is expected to save the company salaries of 60.000 per year. The costs savings should thus be used to repay the web-based system. However, the operation costs of the system will be about 15.000 per year. The annual cost saving, which is the earnings of the investment, is thus (60.000-15.000) = 45.000 per year. We assume that the savings are the same for the entire investment horizon.

The investment horizon is 15 years and there is no expected residual value from the system. The investment in the system is 220.000. The discount rate is set at 16% p.a.

With the assumptions given above, the profitability of the investment can now be calculated using the net present value method:

Calculation of the net present value using NPV in excel:

Period	Investment	Costs savings	Net cash flow
0	-220.000,00		-220.000,00
1		45.000,00	45.000,00
2		45.000,00	45.000,00
3		45.000,00	45.000,00
4		45.000,00	45.000,00
5		45.000,00	45.000,00
6		45.000,00	45.000,00
7		45.000,00	45.000,00
8		45.000,00	45.000,00
9		45.000,00	45.000,00
10		45.000,00	45.000,00
11		45.000,00	45.000,00
12		45.000,00	45.000,00
13		45.000,00	45.000,00
14		45.000,00	45.000,00
15		45.000,00	45.000,00
	Net present value =		30.895,53

Table 23

Since the net present value is positive, the investment is profitable and should be initiated. The investment could, of course, also be evaluated using either the internal rate of return method or annuity method. The conclusion on the investment considered would of course be exactly the same.

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5 CRITICAL VALUES IN INVESTMENTS

Investments are often subject to factors of uncertainty. This is because the earnings are based on budgets and expectations. These are, of course, uncertain.

When an investment is under consideration, it is often a considerable amount of money compared with the daily business of the company. And the annual earnings as well. At the same time, the investment horizon is often several years into the future. Thus, many uncertain data are used in the construction of the investment evaluation.

It can therefore be advantageous for decision-makers to know some maximum and minimum values for the elements included in the investment evaluation. These values are often referred to as critical values. The critical value of some element is the point at which the investment becomes just profitable (the net present value is 0).

Thus, the internal rate of return is a critical value to the project because it returns the net present value of 0 (zero) when used as a discount rate.

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The following example illustrates the use of critical values:

Example 15

A company is considering investing 3.000.000 in a machine for a new project. The investment horizon is set to 8 years and the discount rate at 8% p.a. An income statement budget has been prepared as follows:

Income statement budget:			
	Units	Price	Total
Sales	40.000,00	40,00	1.600.000,00
Cost of goods sold	40.000,00	-8,00	-320.000,00
Contribution margin			1.280.000,00
Cash capacity costs			-650.000,00
Earnings			**630.000,00**

Table 24

We start off by preparing an investment evaluation using the net present value method:

Calculation of the net present value using NPV in excel:			
Assumptions:			
Discount rate		8%	
Sales - units		40.000,00	
Sales price		40,00	
COGS price		-8,00	
Cash capacity costs		-650.000,00	
Period	Investment	Earnings	Net cash flow
0	-3.000.000,00		-3.000.000,00
1		630.000,00	630.000,00
2		630.000,00	630.000,00
3		630.000,00	630.000,00
4		630.000,00	630.000,00
5		630.000,00	630.000,00
6		630.000,00	630.000,00
7		630.000,00	630.000,00
8		630.000,00	630.000,00
	Net present value =		**620.382,53**

Table 25

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The calculation above can be used for calculating the following critical values:

- Discount rate (IRR)
- Sales units
- Sales price
- COGS price
- Capacity costs
- Investment
- Residual value (is assumed 0 right now)

When calculating any critical value, the net present value must be equal to 0 (zero). The critical values must be calculated separately, one at the time. Thus, everything else is kept constant while calculating the critical value. Below, find the calculations of the critical value for sales units:

Calculation of the critical value using Goal seek in excel:

Assumptions:

Discount rate	8%
Sales - units	**36.626,38**
Sales price	40,00
COGS price	-8,00
Cash capacity costs	-650.000,00

Period	Investment	Earnings	Net cash flow
0	-3.000.000,00		-3.000.000,00
1		522.044,28	522.044,28
2		522.044,28	522.044,28
3		522.044,28	522.044,28
4		522.044,28	522.044,28
5		522.044,28	522.044,28
6		522.044,28	522.044,28
7		522.044,28	522.044,28
8		522.044,28	522.044,28
	Net present value =		**0,00**

Table 26

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The calculation shows that the number of minimum units (36.626,38 units) to be sold before the investment is profitable. To find the critical value in Excel we use "Goal seek". When using "Goal seek" in Excel it is important that the critical value is hardcoded and not a formula. If the value is a formula Excel cannot change, it and the critical value cannot be calculated. Find below the Excel sheet showing the assumptions being hardcoded while the calculations using these assumptions are formulas.



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Calculation of the net present value using NPV in excel:

Assumptions:	
Discount rate	0,08
Sales - units	40000
Sales price	40
COGS price	-8
Cash capacity costs	-650000

Period	Investment	Earnings	Net cash flow
0	-3000000		=SUM(B12:C12)
=A12+1		=$B$5*($B$6+$B$7)+$B$8	=SUM(B13:C13)
=A13+1		=$B$5*($B$6+$B$7)+$B$8	=SUM(B14:C14)
=A14+1		=$B$5*($B$6+$B$7)+$B$8	=SUM(B15:C15)
=A15+1		=$B$5*($B$6+$B$7)+$B$8	=SUM(B16:C16)
=A16+1		=$B$5*($B$6+$B$7)+$B$8	=SUM(B17:C17)
=A17+1		=$B$5*($B$6+$B$7)+$B$8	=SUM(B18:C18)
=A18+1		=$B$5*($B$6+$B$7)+$B$8	=SUM(B19:C19)
=A19+1		=$B$5*($B$6+$B$7)+$B$8	=SUM(B20:C20)
Net present value :			=NPV(B4;D13;D14;D15;D16;D17;D18;D19;D20)+D12

Table 27

Below, find the calculations of the critical value for residual value:

Calculation of the critical value using Goal seek in excel:

Assumptions:	
Discount rate	8%
Sales - units	40.000,00
Sales price	40,00
COGS price	-8,00
Cash capacity costs	-650.000,00

Period	Investment	Earnings	Net cash flow
0	-3.000.000,00		-3.000.000,00
1		630.000,00	630.000,00
2		630.000,00	630.000,00
3		630.000,00	630.000,00
4		630.000,00	630.000,00
5		630.000,00	630.000,00
6		630.000,00	630.000,00
7		630.000,00	630.000,00
8	**-1.148.284,78**	630.000,00	-518.284,78
	Net present value =		**0,00**

Table 28

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The calculation shows that the residual value is a maximum cost of 1.148.284,78 before the investment is profitable. To find the critical value in Excel we use "Goal seek".

The calculations of remaining elements included in the investment evaluation can, of course, also be calculated. The procedure is of course the same. The results from this can be found below:

Calculation of the critical values using Goal seek in excel:	
Discount rate	13,23%
Sales price	37,30
COGS price	-10,70
Cash capacity costs	-757.955,72

Table 29



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6 CHOOSING BETWEEN INVESTMENT EVALUATION METHODS

Companies are often confused by which evaluation method to use when considering an investment. If there is only one investment opportunity under consideration, then both the net present value, and the internal rate of return method can be used.

However, if the company has to choose between two or more mutually-exclusive investment opportunities then a word of caution is in order. The internal rate of return method should in general not be used when comparing investments. The example below illustrates this point:

Example 16

A company is considering investing in one of the two mutually-exclusive investment opportunities below. The investment is a rationalization investment which saves costs in the company. As can be seen, the investments and their earnings (cost savings) are very different. Both investments serve the same purpose and, thus, only one of them can be selected.

The details of both investment opportunities can be seen below:

Net present value an internal rate of return for two investments

Discount rate = 8%

Investment oppertunity 1				**Investment oppertunity 2**			
Period	Investment	Earnings	Net cash flow	Period	Investment	Earnings	Net cash flow
0	-550.000,00		-550.000,00	0	-1.100.000,00		-1.100.000,00
1		130.000,00	130.000,00	1		250.000,00	250.000,00
2		130.000,00	130.000,00	2		250.000,00	250.000,00
3		130.000,00	130.000,00	3		250.000,00	250.000,00
4		130.000,00	130.000,00	4		250.000,00	250.000,00
5		130.000,00	130.000,00	5		250.000,00	250.000,00
6		130.000,00	130.000,00	6		250.000,00	250.000,00
7	50.000,00	130.000,00	180.000,00	7		250.000,00	250.000,00
	Net present value =		156.002,63		Net present value =		201.592,51
	Internal rate of return =		15,563%		Internal rate of return =		13,165%

Table 30

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Using the internal rate of return method to choose between the two investments would lead to the first investment of 550.000 since it has an internal rate of return of 15.563% against 13.165% for the second investment. However, percentages are dangerous to compare! The net present value of the second investment of 1.100.000 is the highest and thus should be chosen. Here, the net present value is 201.592,51.

The same conclusion applies for the annuity method as for the internal rate of return method. In general, when choosing between two or more mutually-exclusive investment opportunities the use of the annuity method can lead to wrong decisions.

The annuity method should generally not be used when comparing investments.

The example below illustrates this point:

Example 17

> The same company as previously is considering to invest in one of the two mutually-exclusive investment opportunities below.
>
> The investment is a rationalization investment which saves costs in the company. As can be seen, the investments and their earnings (cost savings) are very different.
>
> Both investments serve the same purpose, and thus, only one of them can be selected. The details of both investment opportunities can be seen below:

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Calculation of economic profit (annuity method) and net present value			
Investment oppertunity 1		**Investment oppertunity 2**	
Investment	-650.000,00	Investment	-1.100.000,00
Residual value	50.000,00	Residual value	0,00
Number of periods	9	Number of periods	7
Dicount rate	8%	Dicount rate	8%
Capital service amount	100.047,83	Capital service amount	211.279,64
Earnings	135.000,00	Earnings	250.000,00
Capital service amount	100.047,83	Capital service amount	211.279,64
Economic profit	**34.952,17**	**Economic profit**	**38.720,36**
Calculation of net present value		**Calculation of net present value**	
Dicount rate	8%	Dicount rate	8%
Number of periods	9	Number of periods	7
Earnings	135.000,00	Earnings	250.000,00
Residual value	50.000,00	Residual value	0,00
Present value of earnings and residual value	868.342,32	Present value of earnings and residual value	1.301.592,51
Investment	-650.000,00	Investment	-1.100.000,00
Present value of earnings and residual value	868.342,32	Present value of earnings and residual value	1.301.592,51
Net present value	**218.342,32**	**Net present value**	**201.592,51**

Table 31

Using the annuity method to choose between the two investments will, in this case, lead to the second investment opportunity of 1.100.000 since it has the largest economic profit of 38.720,36. The first investment opportunity shows an economic profit of 34.953,17 which is lower. However, the first investment has the highest net present value of 218.342,40. This is 16.749,81 higher than the second investment opportunity. Thus, the first investment opportunity should be chosen (accepted).

It is always advisable to use the net present value method when undertaking investment evaluations, where mutually-exclusive investment opportunities are presented. Using either the annuity method or the internal rate of return method can potentially lead to wrong investment decisions. Decisions which can either lead to direct losses (negative net present value) or lead to choosing an investment which will earn the company less than an alternative investment.

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7 INVESTMENTS AND TAXATION

7.1 INTRODUCTION

Most companies pay taxes on their income. Payable taxes are calculated on taxable income. Taxable income is calculated by subtracting deductible costs from the taxable revenue. This sounds very easy, however many accountants and auditors would disagree with this conclusion. National legislation on taxes is in fact far more complicated than the impression you get from the above. Which income is taxable and which costs are deductible is subject to a lot of legislation.



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In this chapter, we will not discuss tax legislation but only introduce how to implement taxes in investment evaluations from some very basic assumptions, which are more or less the same throughout the world. The tax and depreciation rates used are not based on any particular country. Thus, this chapter merely introduces a framework for taxes in investment. When undertaking investment evaluations in practice, you should investigate the tax legislation applicable in the country where the activity under consideration is taxable. If the investment and the income from the investment under consideration are not subject to taxes, the investment evaluation can be prepared with the methods already presented. However, in the opposing situation taxes must be included. Failing to include taxes where they apply may lead to incorrect investment evaluations i.e. accepting an investment with a positive net present value before tax, where the net present value after tax is, in fact, negative. Or vice versa.

A word of caution with regards to including taxes in investment evaluations is in order. Looking into annual accounts you will find that taxes include both payable and deferred taxes. With regards to investment evaluations only payable taxes apply because deferred taxes do not impact cash-flow. Deferred taxes are the result of accrual accounting. In general, deferred taxes are a provision for taxes which will mature in the future. Thus, they should not be taken into consideration before they are actual paid.

7.2 GENERAL ASSUMPTIONS ON TAXES

In the following, we assume that all revenue from the investment is taxable and that all costs are deductible in calculating the taxable income. However, the investment itself is not considered a deductible cost. Usually investments like machinery, equipment and hardware are not allowed to be deducted the year they are acquired. However, they can be depreciated when calculating the tax.

Tax depreciations are often calculated differently from accounting depreciations. This is because accounting legislation and tax legislation pursue different purposes. Here, we will assume that tax depreciations are calculated using the declining balance method with a deprecation rate of 20% per year. Furthermore, we will assume a flat tax rate of 20%.

The following example will illustrate how to include taxes in an investment evaluation.

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Example 18

A company is considering investing in a new activity within its existing business. The investment itself is a new machine which amounts to 6.000.000. The investment horizon is 5 years after which the residual value is expected to be 400.000. The discount rate is 7% p.a. before tax.

Find below the investment evaluation after tax using the net present value method.

Notice that the discount rate of 7% before tax has been converted to a post tax discount rate of (7%*(1-20%)=5,6% by using this formula:

Formula 1

Interest rate after tax = (Interest rate before tax*(1-tax rate))

Investment evaluation including taxes:

Calculation of contribution

Period	Sales	Cost of sales	Contribution
1	2.500.000,00	-1.125.000,00	1.375.000,00
2	2.800.000,00	-1.260.000,00	1.540.000,00
3	2.900.000,00	-1.305.000,00	1.595.000,00
4	2.300.000,00	-1.035.000,00	1.265.000,00
5	2.100.000,00	-945.000,00	1.155.000,00

Calculation of net present value after tax

Discount rate after tax 5,60%

Period	Tax balance	Tax depreciation	Contribution	Taxable income	Payable tax	Investment	Net cash flow
0	6.000.000,00					-6.000.000,00	-6.000.000,00
1	4.800.000,00	-1.200.000,00	1.375.000,00	175.000,00	-35.000,00		1.340.000,00
2	3.840.000,00	-960.000,00	1.540.000,00	580.000,00	-116.000,00		1.424.000,00
3	3.072.000,00	-768.000,00	1.595.000,00	827.000,00	-165.400,00		1.429.600,00
4	2.457.600,00	-614.400,00	1.265.000,00	650.600,00	-130.120,00		1.134.880,00
5	400.000,00	-2.057.600,00	1.155.000,00	-902.600,00	180.520,00	400.000,00	1.735.520,00
Total depreciations		-5.600.000,00			**Net present value =**		**-5.815,41**

Table 32

Notice that the net present value is negative when taking tax into account. This, of course, means that the investment should be rejected.

Had taxes not been included in the investment evaluation the net present value would have been a positive figure of 5.893,44 (see table below). This would mistakenly have led the company to accept the investment.

So when taxes apply they should be included to avoid acceptance of unhealthy projects.

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Investment evaluation before taxes:			
Calculation of contribution			
Year	Sales	Cost of sales	Contribution
1	2.500.000,00	-1.125.000,00	1.375.000,00
2	2.800.000,00	-1.260.000,00	1.540.000,00
3	2.900.000,00	-1.305.000,00	1.595.000,00
4	2.300.000,00	-1.035.000,00	1.265.000,00
5	2.100.000,00	-945.000,00	1.155.000,00
Calculation of net present value before tax			
	Discount rate before tax		7,00%
Year	Contribution	Investment	Net cash flow
0		-6.000.000,00	-6.000.000,00
1	1.375.000,00		1.375.000,00
2	1.540.000,00		1.540.000,00
3	1.595.000,00		1.595.000,00
4	1.265.000,00		1.265.000,00
5	1.155.000,00	400.000,00	1.555.000,00
		Net present value =	**5.893,44**

Table 33



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Notice from the post-tax evaluation the following two issues:

- Tax depreciations are not calculated using the declining balance method in the final year. The depreciation is calculated by subtracting the expected residual value from the end balance from Year 4. This is simply to make sure that the total tax depreciations equal the investment less the residual value. This may not be in accordance with national tax legislation.
- Tax in Year 5 is a positive amount indicating that the company will recover taxes from the tax authorities. Whether this is possible or not is of course subject to national tax legislation. Here, the explanation is that the negative taxable income can be offset against positive taxable income from other activities within the business. Thus, the negative taxable income from the new activity can be used to reduce the total taxable income of the company. This of course results in lower taxes. Since the marginal lower taxes from offsetting negative taxable income is a direct result from the new activity, the positive taxes from this should be included in the investment evaluation for the new activity.

The result found in the example above is that the net present value before tax was -5.815,41 while the net present value before tax was 5.893,44. Obviously the conclusion from this example is that introducing tax will naturally make the investment less favorable. This seams logical when thinking about everyday life where taxes deducted from your paycheck make the net wage less than the gross wage. However, the conclusion from the example above is not a generic conclusion.

Example 19

Consider the following investment:

A company is considering an investment opportunity. The investment has the following assumptions:

- The investment itself is 3.500.000 while the residual value is expected to be 1.000.000.
- The discount rate is 11,5% p.a. before tax.
- The sales, cost of sales and earnings can be seen from the investment evaluation before taxes below:

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Investment evaluation before taxes:

Calculation of contribution

Year	Sales	Cost of sales	Contribution
1	800.000,00	-480.000,00	320.000,00
2	1.000.000,00	-600.000,00	400.000,00
3	2.500.000,00	-1.500.000,00	1.000.000,00
4	3.000.000,00	-1.800.000,00	1.200.000,00
5	3.200.000,00	-1.920.000,00	1.280.000,00

Calculation of net present value before tax

Discount rate before tax 11,50%

Year	Contribution	Investment	Net cash flow
0		-3.500.000,00	-3.500.000,00
1	320.000,00		320.000,00
2	400.000,00		400.000,00
3	1.000.000,00		1.000.000,00
4	1.200.000,00		1.200.000,00
5	1.280.000,00	1.000.000,00	2.280.000,00

Net present value = -70.466,54

Table 34

The conclusion from the calculation of the net present value in Table 34 above is that the investment is not profitable and should not be launched. It would be obvious not to go ahead and calculate the net present value after tax because usually taxes just make things worse. After all, taxes are normally a cost, which reduces the cash-flow needed to repay the investment. As shall be seen below in some cases tax legislation, actually makes unprofitable investments profitable.

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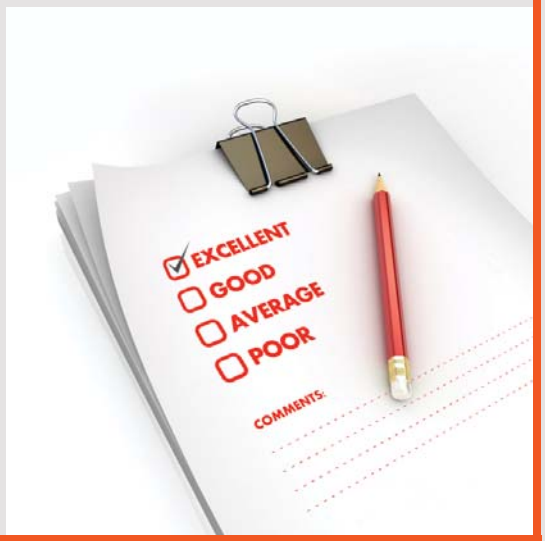
Continuing the example from above the following assumptions about tax depreciations are presented:

- In this case the investment opportunity is supported by special tax depreciation advantages. The investment is in the segment of renewable energy where the government is offering the investors a 40% tax depreciation the first year. In the following years the tax depreciation rate is 20% per year.
- Tax depreciations are calculated using the declining balance method.
- The tax rate is 20%, which makes the discount rate after tax 9,2% p.a.

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Investment evaluation including taxes:

Calculation of contribution

Period	Sales	Cost of sales	Contribution
1	800.000,00	-480.000,00	320.000,00
2	1.000.000,00	-600.000,00	400.000,00
3	2.500.000,00	-1.500.000,00	1.000.000,00
4	3.000.000,00	-1.800.000,00	1.200.000,00
5	3.200.000,00	-1.920.000,00	1.280.000,00

Calculation of net present value after tax

Period	Tax balance	Tax depreciation rate	Tax depreciation	Contribution	Taxable income	Payable tax
0	3.500.000,00					
1	2.100.000,00	40%	-1.400.000,00	320.000,00	-1.080.000,00	216.000,00
2	1.680.000,00	20%	-420.000,00	400.000,00	-20.000,00	4.000,00
3	1.344.000,00	20%	-336.000,00	1.000.000,00	664.000,00	-132.800,00
4	1.075.200,00	20%	-268.800,00	1.200.000,00	931.200,00	-186.240,00
5	1.000.000,00		-75.200,00	1.280.000,00	1.204.800,00	-240.960,00

Total depreciations		-2.500.000,00
Discount rate after tax	9,20%	

Period	Investment	Net cash flow
0	-3.500.000,00	-3.500.000,00
1		536.000,00
2		404.000,00
3		867.200,00
4		1.013.760,00
5	1.000.000,00	2.039.040,00

Net present value = 21.672,55

Table 35

The conclusions from the calculations in Table 34 and Table 35 are captured below:

- Net present value before tax = -70.466,54
- Net present value after tax = 21.672,55

The result from the calculations might seem puzzling and not logical. From the table below the detailed explanation can be found:

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Net present value of tax				
Discount rate	11,5%	9,20%	9,20%	9,20%
Period	Net cash flow before tax	Net cash flow before tax	Payable tax	Net cash flow after tax
0	-3.500.000,00	-3.500.000,00		-3.500.000,00
1	320.000,00	320.000,00	216.000,00	536.000,00
2	400.000,00	400.000,00	4.000,00	404.000,00
3	1.000.000,00	1.000.000,00	-132.800,00	867.200,00
4	1.200.000,00	1.200.000,00	-186.240,00	1.013.760,00
5	2.280.000,00	2.280.000,00	-240.960,00	2.039.040,00
Net present value =	**-70.466,54**	**208.651,28**	**-186.978,73**	**21.672,55**

Table 36

The reason for the investment becoming profitable after tax is that:

- The interest costs are deductible in the taxes
- The lower discount rate after tax causes the cash-flow to reach a higher net present value after tax.

These two reasons cause the net present value to increase by (70.466,54+208.651,28) = 279.117,82. This improvement clearly outweighs the net present value of the payable tax of 186.978,73, making the investment profitable after taxes have been included.

The conclusion regarding taxes is that if any taxes apply for the investment then they should be included, and an after tax calculation of the net present value should be carried out. Looking at a net present value before taxes and concluding that the inclusion of taxes will make the net present value even more negative might be wrong. The example above illustrates this point.

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8 INVESTMENT AND INFLATION

8.1 INTRODUCTION

When evaluating an investment project, it is important to find out whether the data used in the evaluation is including or excluding inflation. Inflation is increase in prices. Of course, the opposite can also occur even though it is not very common. This phenomenon is called deflation.

8.2 INVESTMENT INCLUDING INFLATION – ONE INFLATION RATE

If only one inflation rate is used in investment evaluations, then investment evaluations will show the same net present value using both current prices and fixed prices. In a later section, concerns about multiple inflation rates will be addressed.



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Given the choice the general recommendation is to evaluate investment without inflation. Thus, the amounts included in the investment evaluation are excluding inflation. This is also known as fixed prices. The advantage of evaluating an investment in fixed prices is that it avoids having to budget the inflation rate. Using inflated amounts add extra uncertainty to the investment evaluation. Inflated prices are also referred to as current prices while deflated prices are referred to as fixed prices.

Consider the following example:

Example 20

A company is considering investing in a new business activity. The new activity is expected to create the following earnings:

Expected earnings:	
Period	Earnings in fixed prices
1	234.000,00
2	425.000,00
3	550.000,00
4	450.000,00
5	375.000,00

Table 37

The investment needed is 900.000. All figures above are in fixed prices. The real discount rate is set at 10% p.a. (Real discount rate is excluding inflation).

Now, since all figures are in fixed prices the calculation of the net present value is simple to do:

Period	Investment	Earnings in fixed prices	Net cash flow in fixed prices
0	-900.000,00		-900.000,00
1		234.000,00	234.000,00
2		425.000,00	425.000,00
3		550.000,00	550.000,00
4		450.000,00	450.000,00
5		375.000,00	375.000,00
	Net present value		617.391,63

Table 38

The net present value of the investment is positive and, thus, the investment is profitable.

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If we instead choose to include inflation in the investment evaluation, an inflation rate has to be budgeted. Let us assume that the inflation rate is set at 2,5% p.a. for all the years starting year One.

All the previous earnings must now be converted into current prices using this inflation rate. Also, the real discount rate needs to be converted into a nominal discount rate (nominal discount rate is including inflation).

The investment in Period 0 (zero) is not converted since there is no difference in current prices and fixed prices in that period.

Period	Investment	Earnings in fixed prices	Earnings in current prices	Net cash flow in current prices
0	-900.000,00			-900.000,00
1		234.000,00	239.850,00	239.850,00
2		425.000,00	446.515,63	446.515,63
3		550.000,00	592.289,84	592.289,84
4		450.000,00	496.715,80	496.715,80
5		375.000,00	424.278,08	424.278,08
	Net present value			617.391,63

Table 39

The earnings are converted by using the following formula:

Formula 2

Fixed price amount * (1+v)^n

Where v is the inflation rate and n is the period number.

For Period One to Five the conversions are as follows:

Period One: 234.000 * (1+0,025)^1 = 239.850

Period Two: 425.000 * (1+0,025)^2 = 446.515,63

Period Three: 550.000 * (1+0,025)^3 = 592.289,84

Period Four: 450.000 * (1+0,025)^4 = 496.715,80

Period Five: 375.000 * (1+0,025)^5 = 224.278,08

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The net present value of the net cash flow in current prices is calculated using the nominal discount rate, which is calculated using the following formula:

Formula 3

Nominal discount rate = ((1+ r) * (1 + v))-1

Where r is the real discount rate and v is the inflation rate, thus:

Nominal discount rate = ((1+ 0,10) * (1 + 0,025))-1 = 12,75%

As can be seen from the calculation of the net present value in current prices, it is exactly the same as in fixed prices. And it should be when only one inflation rate is being used.

Let us consider the opposite example:

Example 21

A company is considering investing in a new business activity. The new activity is expected to create the following earnings:

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Expected earnings:	
Period	Earnings in current prices
1	550.000,00
2	700.000,00
3	850.000,00
4	600.000,00
5	300.000,00

Table 40

The investment needed is 2.000.000. All figures above are in current prices. The nominal discount rate is set at 15% p.a. (Nominal discount rate is including inflation). The expected inflation rate is set at 5% pa.

All the previous earnings must now be converted into fixed prices using this inflation rate. Also, the nominal discount rate needs to be converted into a real discount rate (real discount rate is excluding inflation).

The investment in Period 0 (zero) is not converted since there is no difference in current prices and fixed prices in that period.

Investment evaluation in fixed prices				
Perio	Investment	Earnings in current prices	Earnings in fixed prices	Net cash flow in fixed prices
0	-2.000.000,00			-2.000.000,00
1		550.000,00	523.809,52	523.809,52
2		700.000,00	634.920,63	634.920,63
3		850.000,00	734.261,96	734.261,96
4		600.000,00	493.621,48	493.621,48
5		300.000,00	235.057,85	235.057,85
	Net present value			58.655,20

Table 41

The earnings are converted by using the following formula:

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Formula 4

Current price amount / (1+v)^n

Where v is the inflation rate and n is the period number.

For Period One to Five the conversions are as follows:

Period One: 550.000 / (1+0,05)^1 = 523.809,52

Period Two: 700.000 / (1+0,05)^2 = 634.920,63

Period Three: 850.000 / (1+0,05)^3 = 734.261,96

Period Four: 600.000 / (1+0,05)^4 = 493.621,48

Period Five: 300.000 / (1+0,05)^5 = 235.057,85

The net present value of the net cash flow in fixed prices is calculated using the real discount rate, which is calculated using the following formula:

Formula 5

Real discount rate = ((1+ r) / (1 + v))-1

Where r is the nominal discount rate and v is the inflation rate, thus:

Real discount rate = ((1+ 0,15) / (1 + 0,05))-1 = 9,5238%

If we repeat the same approach as with the previous example, and calculate the net present value using current prices and the nominal discount rate, we get exactly the same result. See below:

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Investment evaluation in current prices			
Period	Investment	Earnings in current prices	Net cash flow in current prices
0	-2.000.000,00		-2.000.000,00
1		550.000,00	550.000,00
2		700.000,00	700.000,00
3		850.000,00	850.000,00
4		600.000,00	600.000,00
5		300.000,00	300.000,00
	Net present value		58.655,20

Table 42

Both calculations equal 58.655,20.



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Notice from the calculations above the following conclusions:

- Current prices are larger than fixed prices when using inflation
- Real discount rate and fixed prices are used together
- Nominal discount rate and current prices are used together

Also, notice that, in some cases, amounts are nominal even though they appear fixed. Consider the following example:

A company is considering investing in a new business activity. The activity is expected to earn 100.000 per period in 5 periods. The amount is agreed with the counterpart and cannot be changed – thus it cannot be inflated. The investment is 370.000 and the nominal discount rate is 12% p.a.

Even though the earnings are the same it does not mean that they are in fixed prices. In this case, the earnings have probably been calculated taking into account some overall level of inflation.

Thus, an investment calculation in current prices is done as follows:

Investment evaluation

Period	Investment	Earnings in current prices	Net cash flow in current prices
0	-370.000,00		-370.000,00
1		100.000,00	100.000,00
2		100.000,00	100.000,00
3		100.000,00	100.000,00
4		100.000,00	100.000,00
5		100.000,00	100.000,00
	Net present value		-9.522,38

Table 43

Al though fixed in amount, the earnings are in fact in current prices.

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8.3 INVESTMENT INCLUDING INFLATION – MULTIPLE INFLATION RATES

In the previous review of inflation in investment evaluation, only one inflation rate was taken into consideration. In real life however, the overall inflation consists of price changes on all goods and services in the basket behind the inflation rate. The theory behind calculation of inflation will not be review here. The real life situation with multiple inflation rates will, however, be addressed.

The reason for a separate review of this issue is that, unlike situations with only one inflation rate, the net present value for evaluations in current prices and fixed prices will not be the same using two or more inflation rates. This leaves the question of whether to do the calculation in current or fixed prices and, of course, why.

In general, the overall inflation rate can be used when it is expected that the components of the investment calculation will follow this rate. However, if it is expected that the components of the investment calculations will follow an inflation rate significantly different from the overall inflation, then the components should be inflated separately.

This also suggests that the investment evaluation should be carried out in current prices instead of fixed prices.

Consider the following example to illustrate the above:

Example 22

> A company is considering investing in a new business activity. The investment in connection with this business activity is 2.100.000.
>
> The investment horizon is expected to be 4 years. There is no residual value in connection with this activity. The investment is expected to generate annual sales of 800.000 which is expected to increase by 0,5% p.a. throughout the investment horizon.
>
> The costs connected with the activity are mainly wages, which are estimated at 200.000 p.a. Wages are expected to increase by 2,5% p.a. throughout the investment horizon. The overall inflation is expected be 3,0% p.a. throughout the investment horizon. The real interest rate it set at 5% p.a. Sales and wages are stated in fixed prices.

First, consider the calculation of the earnings from the activity in current prices.

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Calculation of earnings in current prices:

Inflation		0,50%		2,50%	
Period	Sales	Sales in current prices	Wages	Wages in current prices	Earnings in current prices
1	800.000,00	804.000,00	200.000,00	205.000,00	599.000,00
2	800.000,00	808.020,00	200.000,00	210.125,00	597.895,00
3	800.000,00	812.060,10	200.000,00	215.378,13	596.681,98
4	800.000,00	816.120,40	200.000,00	220.762,58	595.357,82

Table 44



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The investment evaluation will look as follows:

Investment evaluation in current prices			
Period	Investment	Earnings in current prices	Net cash flow in current prices
0	-2.100.000,00		-2.100.000,00
1		599.000,00	599.000,00
2		597.895,00	597.895,00
3		596.681,98	596.681,98
4		595.357,82	595.357,82
	Net present value		-128.081,65

Table 45

Nominal discount rate is calculated using the following formula:

Formula 6

Nominal discount rate = ((1+ r) * (1 + v))-1 =

(1+0,05)*(1+0,03)-1 = 8,15% p.a.

The net present value is negative and, thus, the investment is not profitable.

Now how would the same evaluation look if only the overall inflation rate had been used? See the same calculation below, only using an inflation rate of 3% p.a.

Calculation of earnings in current prices:					
Inflation		3,00%		3,00%	
Period	Sales	Sales in current prices	Wages	Wages in current prices	Earnings in current prices
1	800.000,00	824.000,00	200.000,00	206.000,00	618.000,00
2	800.000,00	848.720,00	200.000,00	212.180,00	636.540,00
3	800.000,00	874.181,60	200.000,00	218.545,40	655.636,20
4	800.000,00	900.407,05	200.000,00	225.101,76	675.305,29

Table 46

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The investment evaluation will look as follows:

Investment evaluation in current prices			
Period	Investment	Earnings in current prices	Net cash flow in current prices
0	-2.100.000,00		-2.100.000,00
1		618.000,00	618.000,00
2		636.540,00	636.540,00
3		655.636,20	655.636,20
4		675.305,29	675.305,29
	Net present value		27.570,30

Table 47

The conclusion on the investment evaluation is that the company would have accepted a non-profitable investment, if it had only used the overall expected inflation rate of 3% p.a. The positive net present value of 27.570,30 has been calculated, under the assumption that both sales and wages will grow at 3% p.a., which is not the case.

The expected inflation rates for sales and wages are in fact both lower and have a negative impact of the figures involved. Thus, sales are only expected to grow by 0,5% p.a. while wages are expected to grow by 2,5% p.a. The negative impact causes the earnings to decline in value over the years.

The conclusion regarding the use of inflation rate is that the components investment evaluation should be inflated using their respective expected inflation rates.

The reason for calculating the net present value in current prices instead of fixed prices in the case of multiple inflation rates is that the investment itself must meet the nominal discount rate, including the overall inflation expectations. Investment evaluations in fixed prices do not take the project's specific inflation expectation compared to the overall inflation into consideration, and thus should not be used when multiple inflation rate expectation are present.

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9 INVESTMENT AND WORKING CAPITAL

9.1 INTRODUCTION

In many companies large amounts are tied up in both inventory and trade debtors. There can be various reasons for this. The market the company serves might expect the company to be able to meet their demand at very short notice. Thus, some companies must carry some level of inventory to serve their customers. Failing to do so could potentially lead customers into the arms of eager competitors, who are more than willing to fulfill customer needs and expectations.

In the same way many companies have capital tied-up in trade debtors. Again, in some markets, customers expect to be granted some extension of payment. If the companies serving this market do not provide this service, customers might simply take their business elsewhere.

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On the other hand, companies do not only have customers but are often customers themselves. Depending on the market the company itself might be granted some extension of payment. This extension of payment frees up capital in the company and is, in general known, as trade creditors to the company.

Inventory, trade debtors and trade creditors are known as working capital. Inventory and trade debtors tie up capital, while trade creditors free up capital.

9.2 INCLUDING WORKING CAPITAL IN INVESTMENT EVALUATIONS

Now, what do the above considerations of working capital have to do with investment evaluations? Recall the earlier discussion of cash earnings instead of accounting earnings. The concept was that cash-flow should be included in investment evaluations and not accounting earnings. At the time it was the assumption that all sales and purchases were done in cash. This assumption is now changed. Now sales are no longer paid by customers in cash, inventory levels are no longer zero and the company does not pay its purchases in cash immediately.

Consider the following example to illustrate the above:

Example 23

A company is considering investing in a new business activity. The investment is 1.800.000. The investment horizon is 4 years and there is no residual value. The annual sales and cost of goods can be seen in the table below:

Period	Sales	Cost of goods	Contribution
1	800.000,00	-400.000,00	400.000,00
2	1.200.000,00	-612.000,00	588.000,00
3	1.600.000,00	-864.000,00	736.000,00
4	1.100.000,00	-616.000,00	484.000,00

Table 48

The discount rate is set at 7% p.a. Customers are given 3 months (90 days) to pay while the company itself has 2 months (60 days) to pay its purchases to its suppliers. The company expects that its inventory days will be 160 days on average.

To include working capital, the balance of trade debtors, inventory and trade creditors must be calculated.

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First, the balance and change in trade debtors is calculated using the following formula:

Formula 7

Trade debtors (end) = Sales / turnover rate

Calculation of change in trade debtors			
Trade debtors turnover rate (using 360 days)			4
Period	**Begin**	**End**	**Change**
1	0,00	200.000,00	-200.000,00
2	200.000,00	300.000,00	-100.000,00
3	300.000,00	400.000,00	-100.000,00
4	400.000,00	0,00	400.000,00
		Sum of change	0,00

Table 49

Thus, at the end of Period 1 the balance of 200.000 is calculated as follows:

Trade debtors (end of Period 1) = 800.000 / 4 = 200.000

and at the end of Period 2 the balance of 300.000 is calculated this way:

Trade debtors (end of Period 2) = 1.200.000 / 4 = 300.000

The change in trade debtors is calculated using the following formula:

Formula 8

Change in trade debtors = Begin trade debtors – End trade debtors

This way:

Change in trade debtors (Period 1) = 0 – 200.000 = -200.000

Change in trade debtors (Period 2) = 200.000 – 300.000 = -100.000

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The sign in front of the change amount indicates a negative cash-flow change. This is also logical because an increase in balance from 0 to 200.000 means that the company has capital tied up in trade debtors. And this has a negative impact on cash-flow.

Recall that all balances involved in the investment are settled at the end of the investment horizon. Thus, trade debtors are set at zero at the end of the investment horizon. Thus, the calculated changes in the last period are the begin balance for that particular period. The calculated change in the last period is positive because all trade debtors settle their debt with the company.

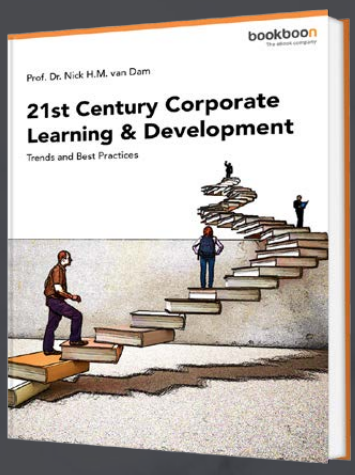
Notice that the sum of changes is zero for the trade debtors, indicating that the balance has been settled.

The calculated changes in trade debtors are used in the final investment evaluation.

Next, the balance and changes in inventory are calculated using the following formula:

Formula 9

Inventory (end) = Cost of sales / turnover rate

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Calculation of change in inventory			
Inventory turnover rate (using 360 days)			2,25
Period	**Begin**	**End**	**Change**
1	0,00	177.777,78	-177.777,78
2	177.777,78	272.000,00	-94.222,22
3	272.000,00	384.000,00	-112.000,00
4	384.000,00	0,00	384.000,00
		Sum of change	0,00

Table 50

Thus at the end of Period 1 the balance of 177.777,78 is calculated as follows:

Inventory (end of Period 1) = 400.000 / 2,25 = 177.777,78

and at the end of Period 2 the balance of 272.000 is calculated this way:

Inventory (end of Period 2) = 612.000 / 2,25 = 272.000,00

The change in inventory is calculated using the following formula:

Formula 10

Change in inventory = Begin inventory – End inventory

This way:

Change in inventory (Period 1) = 0 – 177.777,78 = -177.777,78

Change in inventory (Period 2) = 177.777,78 – 272.000 = -94.222,22

The sign in front of the change amount indicates a negative cash flow change. This is also logical because an increase in balance from 0 to 177.777,78 means that the company has capital tied-up in inventory. And this has a negative impact on cash-flow.

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Recall that all balances involved in the investment are settled at the end of the investment horizon. Thus, inventory is set at zero at the end of the investment horizon. Thus, the calculated changes in the last period are thus the begin balance for that particular period. The calculated change in the last period, is positive because all inventory has been sold.

Notice that the sum of changes is zero for inventory, indicating that the balance has been settled.

The calculated changes in the inventory are used in the final investment evaluation.

Next, the balance and changes in trade creditors are calculated using the following formulas:

Formula 11

Purchases = Cost of sales + inventory end – inventory begin

And:

Formula 12

Trade creditors (end) = Purchases / turnover rate

Calculation of change in trade creditors

Period	Cost of sales	Inventory end	Inventory begin	Purchases
1	400.000,00	177.777,78	0,00	577.777,78
2	612.000,00	272.000,00	-177.777,78	706.222,22
3	864.000,00	384.000,00	-272.000,00	976.000,00
4	616.000,00	0,00	-384.000,00	232.000,00

Trade creditors turnover rate (using 360 days) 6

Begin	End	Change
0,00	96.296,30	96.296,30
96.296,30	117.703,70	21.407,41
117.703,70	162.666,67	44.962,96
162.666,67	0,00	-162.666,67
	Sum of change	0,00

Table 51

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Thus purchases in Period 1 of 577.777,78 are calculated as follows:

Purchases in Period 1 = 400.000 + 177.777,78 – 0 = 577.777,78

Purchases in Period 2 = 612.000 + 272.000,00 – 177.777,78 = 706.222,22

The calculated purchases are now used in the calculation of trade creditors.

At the end of Period 1 the balance of 96.296,30 is calculated as follows:

Trade creditors (end of Period 1) = 577.777,78 / 6 = 96.296,30

and at the end of Period 2 the balance of 117.703,70 is calculated this way:

Trade creditors (end of Period 2) = 706.222,22 / 6 = 117.703,70

The change in inventory is calculated using the following formula:



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Formula 13

Change in trade creditors = End trade creditors – Begin creditors,

This way:

Change in trade creditors (Period 1) = 96.296,30 – 0 = + 96.296,30

Change in trade creditors (Period 2) = 117.703,70–96.296,30=+ 21.407,41

The positive sign in front of the change amount indicates a positive cash flow change. This is also logical because an increase in balance from 0 to 96.296,30 means that the company has set free capital by not paying its debt to trade creditors. And this has a positive impact on cash flow.

Recall that all balances involved in the investment are settled at the end of the investment horizon. Thus, trade creditors are set at zero at the end of the investment horizon.

The calculated changes in the last period are thus the begin balance for that particular period. The calculated change in the last period is negative because all debt to trade creditors is settled by the company.

Notice that the sum of changes is zero for trade creditors, indicating that the balance has been settled.

Finally, the investment evaluation can be prepared. See the table below:

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Investment evaluation including working capital

Period	Investment	Contribution	Change in trade debtors
0	-1.800.000,00		
1		400.000,00	-200.000,00
2		588.000,00	-100.000,00
3		736.000,00	-100.000,00
4		484.000,00	400.000,00

Period	Change in inventory	Change in trade creditors	Net cash flow
0			-1.800.000,00
1	-177.777,78	96.296,30	118.518,52
2	-94.222,22	21.407,41	415.185,19
3	-112.000,00	44.962,96	568.962,96
4	384.000,00	-162.666,67	1.105.333,33
		Net present value =	**-18.899,44**

Table 52

The net present value is negative and the investment is not profitable and should be rejected.

See below for the result if the working capital had not been included in the investment evaluation:

Investment evaluation excluding working capital

Period	Investment	Contribution	Change in trade debtors
0	-1.800.000,00		
1		400.000,00	
2		588.000,00	
3		736.000,00	
4		484.000,00	

Period	Change in inventory	Change in trade creditors	Net cash flow
0			-1.800.000,00
1			400.000,00
2			588.000,00
3			736.000,00
4			484.000,00
		Net present value =	**57.450,27**

Table 53

The result of the investment evaluation excluding working capital is positive. Had the company not taken working capital into consideration, it would have accepted a non-profitable investment.

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10 REPLACEMENT OF INVESTMENTS

10.1 INTRODUCTION

Until now, the asset invested in has been considered a fixed investment during the investment horizon. No consideration about replacement during the investment horizon has been taken into account.

By not considering replacement of the investment, increasing maintenance and service costs are often ignored. Often maintenance and service costs are increasing during the life of the investment, while the residual value of the initial investment is decreasing.

In reality investments can often be halted during the investment horizon. The company can sell the investment and obtain a residual value. This, of course, requires a second-hand market for the used investment assets for the company to sell the asset at.



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Investment assets where second-hand markets exist include:

- Cars (taxis)
- Busses
- Trucks
- Air plans
- Production equipment

Where second-hand markets exist companies can sell their investment assets. Such markets often include a large number of second-hand standard investment assets (none customized).

When to replace or dispose of an investment is dependent on the situation at hand. Consider the following situations:

- The no-replacement situation. A company is considering or is already engaged in an investment. The investment is non-recurring. The company would like to halt the investment within the investment horizon.
- The identical replacement situation. A company has an ongoing business activity for which it has a need for an investment asset. This would be a situation closer to real life. Most companies serve a market and plan to do this for many years. Possibly, as it is bound under a legal contract. In this situation, no development in technology is assumed.
- Replacement of old technology with new technology. As under the "identical replacement situation" but assuming that there is development in technology.

10.2 THE NO-REPLACEMENT SITUATION

To illustrate this situation, consider the following example:

Example 24

A bus company is considering investing in a new business activity. The company is considering opening new routes to new destinations. From the previous opening of new routes, the company knows that, in the start, the routes will generate increasing sales. But when the routes mature and competitors start to move in, the sales will drop. Thus, the company would like to know if the investment is profitable and when it should leave the investment. To open the new routes the company will need to invest in a new bus as its existing capacity of busses are fully utilized. A new bus costs 5.000.000. The expected development in the residual value, the maintenance and service costs and contribution are as follows:

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Period	Residual value	Maintenance	Contribution
0	5.000.000,00	0,00	
1	4.500.000,00	-800.000,00	1.800.000,00
2	3.800.000,00	-900.000,00	2.100.000,00
3	2.700.000,00	-1.000.000,00	2.500.000,00
4	1.200.000,00	-1.400.000,00	2.300.000,00
5	0,00	-2.000.000,00	1.500.000,00

Table 54

The discount rate is set at 5% p.a.

Please note that the situation could also be that the company had already committed itself to the investment. The consideration here is when to leave the investment.

As with any other investment, the company should only accept investments where the net present value is positive. However, in this situation the investment is not a fixed number of years. The investment can be halted at any time during the investment horizon. Therefore, the net present value is therefore calculated for every year during the investment horizon.

The decision-rule is to choose the number of years which show the highest accumulated net present value. Before going into detail with the calculation, consider the result in the calculation below:

Calculation of net present value

Period	Residual value	Depreciation	Interest	Maintenance
0	5.000.000,00			
1	4.500.000,00	-500.000,00	-250.000,00	-800.000,00
2	3.800.000,00	-700.000,00	-225.000,00	-900.000,00
3	2.700.000,00	-1.100.000,00	-190.000,00	-1.000.000,00
4	1.200.000,00	-1.500.000,00	-135.000,00	-1.400.000,00
5	0,00	-1.200.000,00	-60.000,00	-2.000.000,00

Period	Contribution	Net cash flow	PV	Acc. NPV
0				
1	1.800.000,00	250.000,00	238.095,24	238.095,24
2	2.100.000,00	275.000,00	249.433,11	487.528,34
3	2.500.000,00	210.000,00	181.405,90	668.934,24
4	2.300.000,00	-735.000,00	-604.686,32	64.247,92
5	1.500.000,00	-1.760.000,00	-1.379.006,05	-1.314.758,13

Table 55

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From the calculation above the company can see that the highest net present value is obtained by halting the investment at the end of Year 3. Here the accumulated net present value is 668.934,24. The company can also see that the accumulated net present value is positive, meaning that the investment is profitable.

Thus, the conclusion for the company is to go ahead with the investment and to terminate it at the end of Year 3. Find below a detailed explanation of the calculation above.

First, realize that the investment can be halted at any time during the investment horizon. By doing this, the company can sell the bus and obtain the residual value for that particular year. By adding an additional year to the number of years, the residual value will drop. Thus, the company is losing money on the drop in the residual value. This is called depreciation in the calculation above. The depreciation is calculated as follows:

Formula 14

Depreciation = Residual value end – Residual value begin
Depreciation (Year 1) = 4.500.000 – 5.000.000 = -500.000
Depreciation (Year 2) = 3.800.000 – 4.500.000 = -700.000

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The loss above is also known as an opportunity cost.

By remaining with in the investment for an additional year, the company also loses interest on the residual value. If the company had halted the investment, it could have sold the bus and invested the money at the discount rate. By not doing this, the interest not earned is also an opportunity costs and should be included in the calculation. The interest loss is calculated as follows:

Formula 15

Interest = -Residual value begin * discount rate
Interest (Year 1) = -5.000.000 * 0,05 = -250.000
Interest (Year 2) = -4.500.000 * 0,05 = -225.000

The maintenance costs and contribution have been included on the basis of the assumptions given earlier. The net cash flow is a sum of the costs and contribution:

Net cash flow (Year 1) = -500.000-250.000-800.000+1.800.000 = 250.000
Net cash flow (Year 2) = -700.000-225.000-900.000+2.100.000 = 275.000

The present value is calculated using the PV function in Excel:

Calculation of present value using "PV" in excel		
	Period 1	Period 2
Rate	0,05	0,05
Nper	1	2
Pmt	0	0
Fv	-250.000,00	-275.000,00
PV =	**238.095,24**	**249.433,11**

Table 56

The accumulated net present value is calculated as follows:

Formula 16

Accumulated NPV = Accumulated NPV begin + PV
Accumulated NPV (Year 1) = 0 + 238.095,24 = 238.095,24
Accumulated NPV (Year 2) = 238.095,24 + 249.433,11 = 487.528.34 (occur of rounding)

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10.3 THE IDENTICAL REPLACEMENT SITUATION

To illustrate this situation, consider the following example:

Example 25

A bus company has for many years operated city bus lines for the municipality under contract. The company has committed itself to a 10-year contract which it cannot leave during the contract period. The remaining contract period is 8 years. Since the company has already committed itself to a contract which it cannot leave, the sales can be disregarded. Instead the company should focus on minimizing the costs relating to operating the contract during the remaining period of 8 years.

The company thus has to consider how to operate at the lowest possible costs. To continue operating the city line, the company will need to invest in a new bus since the old bus is worn out and the existing capacity of busses are fully utilized. A new bus costs 5.000.000. The expected development in the residual value, maintenance and service costs are as follows:

Period	Residual value	Maintenance
0	5.000.000,00	
1	4.000.000,00	-800.000,00
2	3.050.000,00	-800.000,00
3	2.200.000,00	-1.400.000,00
4	1.200.000,00	-1.800.000,00
5	0,00	-2.500.000,00

Table 57

The discount rate is set at 5% p.a. In this situation, it is an underlying assumption that there is no development in technology. Therefore, the company can always replace the bus above with a new bus at the same price and maintenance costs. Nothing changes!

Therefore, the company should consider when to replace the bus with a new bus. The decision-rule is to choose the number of years which show the lowest average annual cost. Before going into detail with the calculation, consider the result in the calculation below:

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Calculation of average annual cost

Period	Residual value	Depreciation	Interest	Maintenance
0	5.000.000,00			
1	4.000.000,00	-1.000.000,00	-250.000,00	-800.000,00
2	3.050.000,00	-950.000,00	-200.000,00	-800.000,00
3	2.200.000,00	-850.000,00	-152.500,00	-1.400.000,00
4	1.200.000,00	-1.000.000,00	-110.000,00	-1.800.000,00
5	0,00	-1.200.000,00	-60.000,00	-2.500.000,00

Period	Net cash flow	PV	Acc. NPV	Avg. Annual costs
0				
1	-2.050.000,00	-1.952.380,95	-1.952.380,95	-2.050.000,00
2	-1.950.000,00	-1.768.707,48	-3.721.088,44	-2.001.219,51
3	-2.402.500,00	-2.075.369,83	-5.796.458,27	-2.128.509,12
4	-2.910.000,00	-2.394.064,20	-8.190.522,47	-2.309.824,25
5	-3.760.000,00	-2.946.058,39	-11.136.580,85	-2.572.269,51

Table 58



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From the calculation above the company can see that the lowest average annual cost is obtained by replacement of the investment at the end of Year 2. Here the average annual cost is 2.001.219,51 per year for 2 years. Hence, the bus company should replace the bus every second year.

Please note that the calculation does not tell us if the investment is profitable or not. This is not at interest at all since the company must continue operating under the contract for another 8 years.

Find below a detailed explanation of the calculation above.

First, realize that the bus can be replaced at any time during the investment horizon. By doing this, the company can sell the bus and obtain the residual value for that particular year. By adding an additional year to the number of years, the residual value will drop. Thus, the company is losing money on the drop in the residual value. This is called depreciation in the calculation above. The depreciation is calculated as follows:

Formula 17

Depreciation = Residual value end – Residual value begin
Depreciation (Year 1) = 4.000.000 – 5.000.000 = -1.000.000
Depreciation (Year 2) = 3.050.000 – 4.000.000 = -950.000

The loss above is also known as an opportunity cost. By keeping the bus for an additional year, the company also loses interest on the residual value. If the company replaced the bus it could have sold the old bus and invested the money at the discount rate. By not doing this, the interest not earned is also an opportunity cost and should be included in the calculation. The interest loss is calculated as follows:

Formula 18

Interest = -Residual value begin * discount rate
Interest (Year 1) = -5.000.000 * 0,05 = -250.000
Interest (Year 2) = -4.000.000 * 0,05 = -200.000

The maintenance costs are included on the basis of the assumptions given earlier. The net cash-flow is a sum of the costs:

Net cash flow (Year 1) = -1.000.000-250.000-800.000 = -2.050.000
Net cash flow (Year 2) = -950.000-200.000-800.000 = -1.950.000

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The present value is calculated using the PV function in Excel:

Calculation of present value using "PV" in excel		
	Period 1	Period 2
Rate	0,05	0,05
Nper	1	2
Pmt	0	0
Fv	-2.050.000,00	-1.950.000,00
PV =	**1.952.380,95**	**1.768.707,48**

Table 59

The accumulated net present value is calculated as follows:

Formula 19

Accumulated NPV = Accumulated NPV begin + PV
Accumulated NPV (Year 1) = 0 – 1.952.380,95 = – 1.952.380,95
Accumulated NPV (Year 2) = -1.952.380,95 – 1.768.707,48 = 3.721.088,44 (occur of rounding)

Finally, the average annual costs are calculated using the Excel function PMT:

Calculation of average annual costs using "PMT" in excel		
	Period 1	Period 2
Rate	0,05	0,05
Nper	1	2
Pv	1.952.380,95	3.721.088,44
PMT =	**-2.050.000,00**	**-2.001.219,51**

Table 60

Thus, the calculation of the average annual costs is taking interest into consideration, which it should, because the costs are settled in different periods. Thus, simply dividing the accumulated NPV with the number of years would be wrong as it disregards interest.

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10.4 REPLACEMENT OF OLD TECHNOLOGY WITH NEW TECHNOLOGY

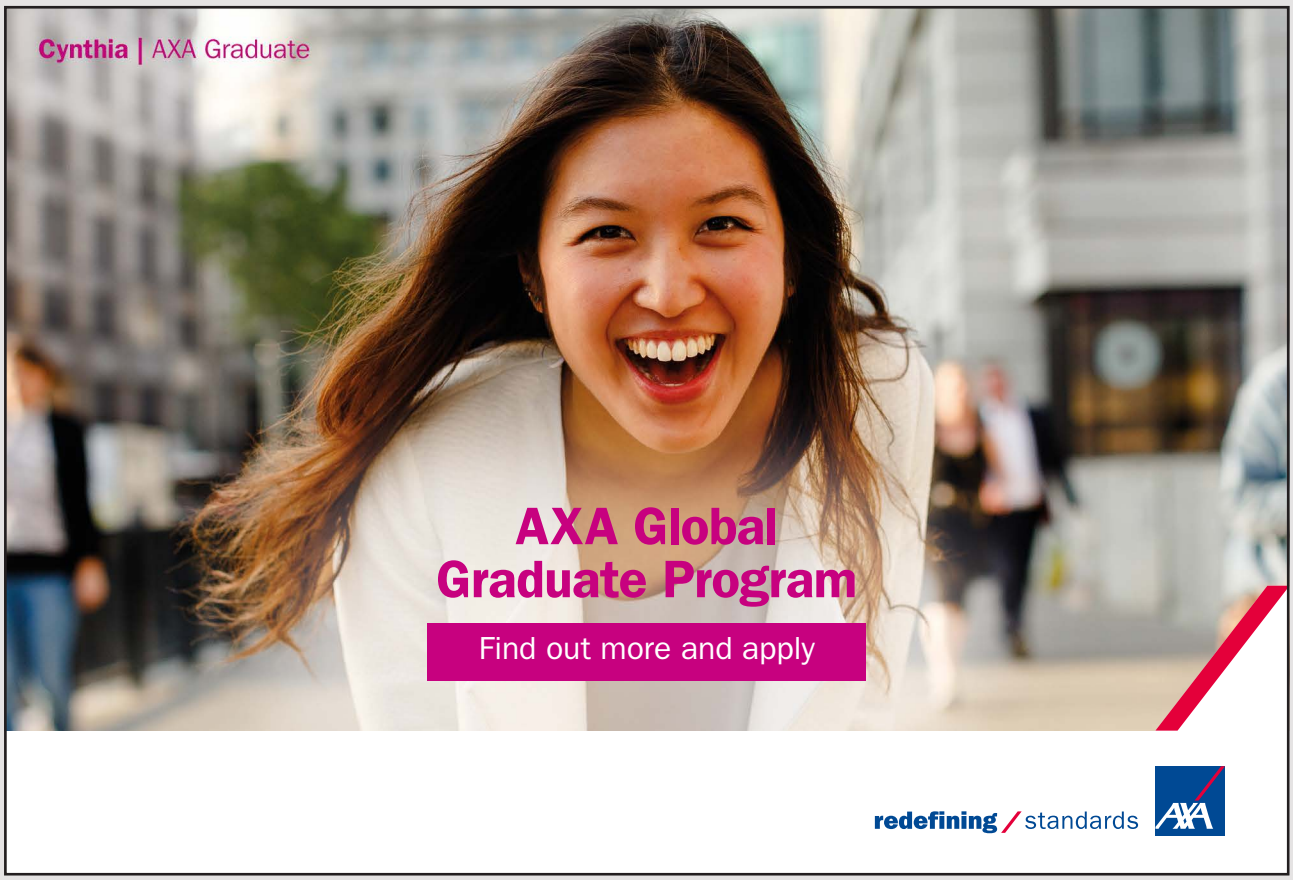
To illustrate this situation, consider the following example:

Example 26

A bus company has for many years operated city bus lines for the municipality under contract. The company has committed itself to a 10-year contract which it cannot leave during the contract period. The remaining contract period is 8 years. Since the company has already committed itself to a contract which it cannot leave, the sales can be disregarded. Instead, the company should focus on minimizing the costs relating to operating the contract during the remaining period of 8 years.

The company thus has to consider how to operate at the lowest possible costs.

The bus company already owns a bus. The expected development in the residual value, the maintenance and service costs for the current bus are as follows:



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Period	Residual value	Maintenance
0	4.900.000,00	
1	4.000.000,00	-650.000,00
2	3.050.000,00	-675.000,00
3	2.200.000,00	-1.300.000,00
4	1.200.000,00	-1.700.000,00
5	0,00	-2.400.000,00

Table 61

The discount rate is set at 5% p.a.

The company has just received an offer for a new bus (new technology). The expected development in the residual value and the maintenance and service costs for the offered bus are as follows:

Period	Residual value	Maintenance
0	7.000.000,00	0,00
1	6.000.000,00	-700.000,00
2	5.500.000,00	-800.000,00
3	4.200.000,00	-900.000,00
4	3.000.000,00	-1.200.000,00
5	1.200.000,00	-1.500.000,00

Table 62

In this situation, it is an underlying assumption that there is development in technology. Therefore, the company can always replace the bus above with a new bus. However, at changed price and maintenance costs.

The company is now considering when it should replace the current bus with a new bus. The decision-rule in this situation to replace the old bus with the new bus the year before the net cash flow of the old bus exceeds the lowest average annual cost of the new bus. The decision involves two sets of calculations:

- Calculation of the lowest average annual cost for the new bus
- Calculation of net cash flow for the old bus

The calculation of the lowest average annual cost for the new bus is prepared as shown above, under the identical replacement situation. The result of this can be found below:

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Calculation of average annual cost - New bus

Period	Residual value	Depreciation	Interest	Maintenance
0	7.000.000,00			
1	6.000.000,00	-1.000.000,00	-350.000,00	-700.000,00
2	5.500.000,00	-500.000,00	-300.000,00	-800.000,00
3	4.200.000,00	-1.300.000,00	-275.000,00	-900.000,00
4	3.000.000,00	-1.200.000,00	-210.000,00	-1.200.000,00
5	1.200.000,00	-1.800.000,00	-150.000,00	-1.500.000,00

Period	Net cash flow	PV	Acc. NPV	Avg. Annual costs
0				
1	-2.050.000,00	-1.952.380,95	-1.952.380,95	-2.050.000,00
2	-1.600.000,00	-1.451.247,17	-3.403.628,12	-1.830.487,80
3	-2.475.000,00	-2.137.998,06	-5.541.626,17	-2.034.932,59
4	-2.610.000,00	-2.147.253,46	-7.688.879,63	-2.168.355,04
5	-3.450.000,00	-2.703.165,27	-10.392.044,91	-2.400.300,47

Table 63

The lowest average annual costs for the new bus is 1.830.487,80 which should be compared against the net cash flow from the current bus:

Next, the cash flow from the old bus is calculated. This is also prepared as with the previous identical replacement situation. The result of this can be found below:

Calculation of net cash flow - Old bus

Period	Residual value	Depreciation	Interest	Maintenance
0	4.900.000,00			
1	4.000.000,00	-900.000,00	-245.000,00	-650.000,00
2	3.050.000,00	-950.000,00	-200.000,00	-675.000,00
3	2.200.000,00	-850.000,00	-152.500,00	-1.300.000,00
4	1.200.000,00	-1.000.000,00	-110.000,00	-1.700.000,00
5	0,00	-1.200.000,00	-60.000,00	-2.400.000,00

Period	Net cash flow
0	
1	-1.795.000,00
2	-1.825.000,00
3	-2.302.500,00
4	-2.810.000,00
5	-3.660.000,00

Table 64

Since the net cash flow from the old bus exceeds the average annual costs of 1.830.487,80 in Year 3, the old bus must be replaced in Year 2. The reason for this is that keeping the bus another year (from Year 2 to Year 3) will mean marginal cost of 2.302.500 for that extra year. This is above the average annual cost of the new bus and should thus be avoided.

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11 WHAT TO INCLUDE IN REAL LIFE?

So far inflation, taxes and net working capital have been reviewed. But when should they be taken into consideration? In general, the investment evaluation should reassemble the life of the investment case such as it is expected to be. If taxes are applicable, they should of course be included. If inflation is expected it too should be included. The same goes for net working capital.

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12 FINANCING

12.1 INTRODUCTION

We will start by defining financing.

Financing is how companies fund their total investments or specific assets.

The financial situation at a certain time can be seen in the balance sheet in the liabilities. Here, you can see how much capital there is in the company and in how it has been raised. The capital is supplied by the owners as equity and from external creditors as debt.

For a company to be able to invest, it needs financing in some way. Investment and financing are closely connected. To be able to make an investment the company must be able to finance it.

What distinguishes the two terms can be seen from the following definitions:

- An investment is a series of cash flows starting with a payment (the initial investment)
- Financing is a series of cash flows starting with a receipt (the proceeds from the loan)

The following table shows the principal content of the balance sheet and the connection between assets and the way capital can be raised.

Read the table starting in the middle and work your way from either right or left to get more details.

<table>
<tr><th colspan="6">Principle Balance sheet as per 31.12.</th></tr>
<tr><th>Assets</th><th>Assets</th><th>Assets</th><th></th><th>Liabilities</th><th>Liabilities</th><th>Liabilities</th></tr>
<tr><td>Tangible assets</td><td rowspan="2">Fixed assets</td><td rowspan="5">Total assets</td><td rowspan="5"></td><td rowspan="5">Total liabilities</td><td rowspan="2">Equity</td><td>Share or stock capital</td></tr>
<tr><td>Intangible assets</td><td>Retained earnings</td></tr>
<tr><td>Inventory</td><td rowspan="3">Current assets</td><td>Long term debt</td><td>Bank loans</td></tr>
<tr><td>Trade debtors</td><td rowspan="2">Short term debt</td><td>Overdraft accounts</td></tr>
<tr><td>Cash in hand and at bank</td><td>Trade creditors</td></tr>
</table>

Table 65

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From the table it can be seen that, in principle, there are two ways to raise capital (or fund investments):

- Equity
- Debt

12.2 EQUITY FINANCING

Responsible capital raised by the company from the owners either through shares or by stocks. "Responsible" means that in the event of a loss from the income statement, the raised capital will suffer before the creditors do.

Stock capital is equity raised through a public offering on a stock exchange (IPO). Here, investors can buy and sell the stocks in the company.

Share capital is equity raised outside the stock exchange. Buying and selling shares not listed on a stock exchange can be more complicated for investors as no real market place exists. Thus, investors wanting to sell and investors wanting to buy can have a hard time finding one other.

Retained earnings are withheld earnings from the income statement, not yet transferred to the owners as dividend.

12.3 DEBT FINANCING

Capital raised by the company from external creditors can be divided into two categories:

- Long term debt (payback period later than one year)
- Short term debt (payback period within one year)

Capital raised by the company from external creditors can also be divided into two other categories:

- **Financing debt**. Debt raised as a consequence of an actual funding need. For example, a company could have a funding need in connection with an investment in a machine, building etc. To do this, investment capital needs to be raised for a longer period of time and on a more permanent basis. Permanent basis means that the terms e.g. interest, repayment pattern etc. are known and that some sort of financing contract is agreed upon with the counterpart.

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- **Working debt**. Working debt raised as a consequence of doing business in general. Unlike financing debt, working debt is not normally used for the funding of investment. This is because working debt is usually very short term and not on a permanent or in any committed basis. An example of working debt could be trade creditors. Debt to trade creditors is usually a consequence of purchasing inventory and not paying cash. The payment terms connected to this form of financing is anywhere from 8 days to 3 months. Thus, such short term non-permanent financing should not be used for financing investments, which are usually long term commitments. However, this is only a general consideration which does not apply in all cases.

Examples of financing debt include the following general financial products:

- Mortgage loans from mortgage institutions. Some loans are financed by issuing bonds to finance the loans. Others are just ordinary loans granted by the institute itself. Both are however secured by registration of the mortgaged property in the event of default. The assets are pledged as security.
- Loans and overdraft accounts from financial institutions such as banks. Loans can be short term and long term in both local and foreign currency.



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- Commercial papers (bonds) issued by the company itself. Commercial papers can be short term and long term in both local and foreign currency.
- Intercompany loans from parent company to a subsidiary company. Intercompany loans can be short term and long term in both local and foreign currency.
- The list is not exhaustive.

Examples of **working debt** include the following general items raised as a consequence of doing business:

- Trade creditors. Debt raised in connection with trading with suppliers.
- VAT due. Debt raised in connection with applying with VAT rules.
- Withheld income taxes, pension contributions and other public charges.
- The list is not exhaustive.

From time to time, it is necessary for the company to bridge a financing gap. This is done by opening an overdraft account in a financial institution such as a bank. The purpose of the overdraft account is usually to bridge the liquidity gap, when working debt is settled until new cash inflow arrives (e.g. payment from trade debtors). So, an overdraft account is in reality financing debt, but for the temporary bridging of liquidity fluctuations.

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13 FINANCING CONSIDERATIONS

13.1 INTRODUCTION

Some companies like their fixed assets to be financed by equity plus financing debt. This is because they do not want their long running investments to be dependent on financing from short term and uncommitted debt. This corresponds with the discussion under working debt above. There is no general formula for calculating the right financing mix for the company. Financing mix means deciding upon debt (working debt and financing debt) and equity financing for the company. In the following, we will look into different conditions to consider when deciding upon the financing mix etc. The following considerations are not exhaustive.

13.2 BUSINESS ENVIRONMENT

The nature of the company's business environment is very important to take into consideration when considering how to finance investments.

Consider the following two types of business environment:

13.2.1 STABLE BUSINESS ENVIRONMENT

Companies in a stable business environment are, in general, faced with a stable demand for their products. The products are mature and so is the technology producing them. Because of the very stable business environment, the profit and cash flow from these activities are usually also very stable. In such environments, a relative high degree of debt financing could be a possibility. The reason for this is that debt financing demands some sort of structured settlement (payment pattern). This works very well with a stable cash flow business. The stability in the settlement of the debt financing is well matched with the relative stable cash-flow from business activities. Lenders such as financial institutions will often recognize this and will be willing to engage in a relative high degree of debt financing. For a more complex and thorough analysis on the business environment and products consult Michael E. Porter's Five Forces Framework, Boston Consulting Groups Matrix Framework and T. Levitt's Product Life Cycle Framework.

Companies in stable business environments include manufacturers of e.g. lawn movers, utility companies (water, heating, electricity) etc.

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13.2.2 DYNAMIC BUSINESS ENVIRONMENT

Companies in a dynamic business environment are, in general, faced with a more volatile demand for their products. The products are new and under constant development and modification, due to fierce competition in the market. The growth rates in these business environments are usually high. The technology used to produce the products is also under constant development.

Because of the dynamic business environment, the profit and cash flow from these activities are usually more volatile. In such environments, a relative high degree of equity financing should be considered. The reason for this is that equity, unlike debt financing, does not demand a structured settlement (payment pattern). Also, lenders such as financial institutions, will probably be very reluctant to engage in lending programs with a high debt financing degree and high risk of default. Lenders will, in general, prefer a relative high degree of equity as a buffer zone against losses from the dynamic business environment. Thus, shareholders will suffer before lenders do. Lenders do not wish to put their hand on a hot stove unless the shareholders are willing to participate on a qualified basis. Participation on a qualified basis means that shareholders must engage in such a way that the risk of potential lenders is significantly reduced. Usually this is done by financing the company with a relative high degree of equity.



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Another reason for considering a high degree of equity financing is that long term investments in dynamic business environments have a higher likelihood of incurring losses during the life of the investment. Refinancing of debt financing during a period of losses on a committed investment can be extremely hard. The Financial Crisis (2007–) has shown that sources of finance can dry up completely, even when rejecting refinancing debt means the default of a company. Some financial institutions reject refinancing of debt event when it means a non-recoverable loss.

Also, new capital can be hard to find when an investment is making a loss. Therefore, it is essential for companies in a dynamic business to finance their investments on long term financing commitments, such as equity.

Companies in dynamic business environments include manufacturers of e.g. smart phones and software.

When a company is to choosing between different ways of financing, there are several conditions to be considered. We will look further into these in the following sections.

13.3 LOAN TERMS

The terms of the loan are in most cases specified in the loan agreement between the company and the financial institution. In the following some of the more general loan terms are reviewed and discussed.

13.3.1 LOAN PERIOD

The loan period is the number of years granted to the company from the financial institution to repay the loan. The loan period, together with the interest and way of amortization, decide the size of the periodic payment for the company to pay. It is therefore important for the company to decide upon a loan period which, together with the other loan parameters, fits the purpose of the loan, as well as the cash flow needed to servicing it.

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Some companies prefer the loan period to match the life of the investment for which the loan has to be used. Whether this makes sense or not is dependent on the situation at hand. This rule of thumb requires that the loan actually matches the investment. Companies, which do so often, argue that the value of the asset must match the balance of the debt at any given time during the loan period. The reasons behind this strategy are multiple:

- Companies prefer to have the opportunity to sell the asset and use the proceeds from this sale to repay the remaining balance of the loan. This strategy of course requires that the asset can be sold at any given time.
- Companies do not want to end up with a useless worn out asset while still having to repay debt financing it. In such a situation, companies could potentially end up having to lend more money to finance a new asset, which is replacing the useless worn out asset.

Using the "match loan period with asset life" strategy makes good sense, if the debt is only used for the purpose of a particular investment. However, if the debt is used for more static financing of the company, this could lead to a potential default of the company. The situation could be that the current assets are always exceeding the short term debt, creating a permanent need for financing. In such situations, using the "match loan period with asset life" strategy is a potential dangerous choice.

The above leaves the unanswered question of which loan period to choose. Choosing a long loan period, the company risks ending up with a useless worn out asset while still having debt to repay. Choosing too short a loan period the company risks tight liquidity, since the cash-flow from the investment might not cover the payments of the financing. This could potential lead to default of the company.

If the loan is for an investment for a 10-year period, where the earnings will be spread out over 10 years, it will not be wise with a 1-year loan. This could potential cause another financing problem, as the repayment of the 1-year loan cannot be done by means of the earnings from the investment in Year 1. Thus, choosing too short at loan period could cause the company to go bankrupt even though the cash-flow from the investment can cover the repayment of the loan over the investment horizon.

13.3.2 NOMINAL VALUE

The loan document between the company and the financial institution usually also stipulates the nominal value of the loan. The nominal value (or face value) is the amount which the company actually has to repay. In contrast to the nominal value is the proceeds from the loan. The proceeds are the amount from the loan being paid to the company, at the time the loan is provided to the company.

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13.3.3 INTEREST AND COMMISSION COSTS (COST AND RISK)

The cost of the loan is also of interest to the company. One of the costs associated with the loan is interest. Interest is what the company pays for lending money.

The interest is usually stipulated as a percentage e.g. 10% p.a. The interest can be stipulated as an annual percentage or a percentage per period.

The fixing of the interest rate in the contract can be either fixed rate or variable rate. Under a fixed rate loan, the interest rate is fixed for the entire loan period without any possibility of changing it. Under a variable rate loan, the loan contract usually stipulates how often the interest rate is subject to fixing. Some variable rate loans use day-to-day interest rates, while other variable rate loans use 3-month interest rates. The term fixing refers to the time interval with which the interest rate is set.



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Considerations about fixed or variable interest rates are very important to the company. Choosing a variable rate loan could provide the company with a low interest rate right now, at the risk of higher interest at the coming interest fixing. Of course the interest rate could also drop at the next interest fixing. Whatever the company chooses, it should carefully consider the consequence of its choice. An interest rate increase at the coming interest fixing could potentially ruin the company. Thus, careful considerations about the risk under a variable interest rate loan is in order.

A strategy to avoid the risk associated with the variable rate loans is, of course, to use fixed-rate loan. Here, the risk of interest rate increases is avoided. On the downside, any interest drop will not benefit the company. However, some companies are willing to give up the possibility of a potential drop in interest rates, just to avoid the risk of increases in interest rates. This is of course a strategy. Companies should, however, bear in mind that fixed-interest rates are normally higher than variable interest rates. The interest rate difference is the compensation companies must pay to the financial institution to get eliminate the interest risk. From time to time, fixed-interest rates are lower than variable interest rates. This is, however, not a normal market situation.

Terms like nominal and effective interest rate are also used. Nominal interest rate is the interest rate, only including the actual interest rate, without taking compounded interest, commission costs and bond rate losses into account. Effective interest rate takes all costs associated with the loan into account.

Commission costs are cost related to the financial institutions issue of the loan and credit assessment of the company. These costs are usually deducted from the nominal value of the loan before the loan is paid to the company.

13.3.4 CALCULATION OF PROCEEDS

Depending on the financial institution, the loan can be either a normal bank loan or a bond loan. If the loan is a bank loan, the commission costs have to be deducted before the proceeds from the loan can be paid to the company.

Commission costs are costs related to the financial institutions issue of the loan and credit assessment of the company. These costs are deducted from the nominal value of the loan before the loan is paid to the company.

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After deducting the commission costs from the nominal value or the bank loan, the rest is paid to the company as proceeds. Depending on the commission costs, there can be a rather substantial difference between the nominal value of the loan and the proceeds.

Consider the following to illustrate the calculation of the proceeds from a bank loan:

Calculation of proceeds from a bank loan	
Nominal value	1.000.000,00
Commission costs	-12.000,00
Proceeds	**988.000,00**

Table 66

Of course, it is the nominal value of the loan that the company needs to repay.

A bond loan is funded by issuing bonds. Before paying any proceeds to the company, the financial institution must first issue and sell bonds to finance the loan. When selling the bonds in the bond market, the bonds are sold at the bond price. This is the price which seller and buyer agree upon. If the bond rate is 95 then the seller receives 95 of every 100 issued in bonds. The remaining 5 is a bond loss. The seller receives 95 from the buyer but will have to repay the 100. To calculate what the seller gets from the sale of the bonds, the nominal value is simply multiplied by the bond rate and divided by 100. This represents the market value of the bond. The financial institution normally acts as the seller of the bonds in the financial markets on behalf of the company.

From the market value, the commission costs are deducted before paying the proceeds to the company.

Consider the following to illustrate the calculation of the proceeds from a bond loan:

Calculation of proceeds from a bond loan	
Nominal value	1.000.000,00
Bond rate	95,00
Market value	950.000,00
Commission costs	-8.000,00
Proceeds	**942.000,00**

Table 67

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Again as with the bank loan, it is the nominal value of the loan the company needs to repay and not the proceeds.

The bond rate loss and the commission costs mean that the nominal value of the loan is not the same as the proceeds. The company should realize this when applying for a loan at a financial institution. If the company needs the loan to finance an investment of say 2.000.000 the proceeds from the loan should equal 2.000.000. Thus, depending on loan the company should flip the calculation to see what nominal value the loan should have to cover the 2.000.000 needed.

Consider the following to illustrate the calculation of the nominal value from the proceeds on a bond loan:

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Calculation of nominal value of a bond loan	
Proceeds	2.000.000,00
Commission costs	-10.000,00
Market value	2.010.000,00
Bond rate	93,00
Nominal value	**2.161.290,32**

Table 68

The example shows that the company needs a loan with a nominal value of 2.161.290,32 to receive proceeds of 2.000.000. Had the company simply asked for a loan of 2.000.000 it would have been short of cash to pay the investment of 2.000.000. The illustration also applies for bank loans.

13.3.5 LOAN REPAYMENT (LIQUIDITY)

The company carefully needs to consider the liquidity of the loan. The liquidity of the loan is the repayment pattern under which the loan has to be repaid. The liquidity of the loan is dependent on the type of loan. The repayment pattern is normally referred to as amortization of the loan. For bond loans and bank loans there are 3 generic forms of amortization:

- Standing loan (bullet loan)
- Serial loan
- Annuity loan

The form of amortization is normally set throughout loan period and not subject to change during the loan period.

A more thorough review of the generic amortization forms and the considerations in connection with this can be found in Chapter 14.0 Amortization of loans.

13.3.6 EXTENSION OF REPAYMENT (FLEXIBILITY)

The company also needs to consider if it would potentially need to extend the repayment of the loan. This is sometimes also referred to as "amortization holiday". If the company is almost sure that it will need an extension of repayment, it should consider choosing another form of amortization. This applies when the uncertainty relates to the timing of the cash-flow. If the uncertainty of the cash-flow has to do with a general uncertainty about the financial situation of the company, the company should consider not applying for a loan at all.

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Not all financial institutions provide the possibility of amortization holiday. If this is not the case, the company should carefully consider mixing its total financing package with loans and credit facilities, which have the flexibility it requires. To illustrate this see the example below:

Example 27

Consider a company which needs to finance a new investment. The timing of the cash flow from the investment is somewhat unsure to the company. The company would therefore like some prearranged flexibility built into its financing of the investment. However, the financial institution serving the company does not offer amortization holiday at all. The financial institution only offers generic amortization forms on loans and overdraft accounts.

The company has a finance need of 4.000.000, which needs to be meet in order to pay for the investment. The company could build its financing package in several ways to meet both its financing need and the timing uncertainty related to the cash flow. The financing package should always be based on projected cash flow budgets. The following are just generic examples to suggest the mixing of loans and overdraft facilities to meet the finance need.

Financing package	
Bank loan (annuity amortization)	4.000.000
Total financing package	**4.000.000**

Table 69

The suggestion above clearly does not in any way meet the company's need for flexibility, since the amortization is prefixed covering the entire financing need.

Financing package	
Bank loan (annuity amortization)	2.000.000
Overdraft account	2.000.000
Total financing package	**4.000.000**

Table 70

The second suggestion to some extent has flexibility built in. The overdraft account represents the flexibility. The overdraft account is a non-scheduled facility, which means that the company does not have to repay at prearranged maturity dates. This, of course, adds flexibility to the financing package.

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The proportion of overdraft account to bank loan is of course subject to judgment. It could be higher or it could be lower, depending on the uncertainty believed associated with cash flow from the investment.

Financing package	
Overdraft account	4.000.000
Total financing package	**4.000.000**

Table 71

The final suggestion is of course the most flexible one and could thus seem very appealing to the company. This flexibility however comes at a cost. The cost in most cases is that overdraft accounts carry higher interest rates than bank and bond loans. So, choosing the above suggestion could potentially be very costly to the company. In contrast to this, the company could choose the first suggestion because it would without doubt be cheaper in terms of interest. Choosing this suggestion does, however, come with the cost of no flexibility at all. The company needs carefully to consider the mixture of the financing package. In Chapter 17.0 Financial planning, considerations on mixing financing will be addressed.



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13.3.7 EARLY REPAYMENT (FLEXIBILITY)

The opposite situation for extension of repayment also needs to be considered. The company might want to repay the loan earlier than initially agreed in the contract with the financial institution. Some financial institutions offer this possibility in their contracts. However, other financial institutions do not offer this possibility. In such situations, the company carefully needs to consider the mixing of the financing package in the same way it did under Section 13.3.6 above. In Chapter 17.0 Financial planning, considerations on mixing financing will be addressed. Asking for an early repayment in the contract with the financial institution usually comes at a cost. Therefore, the company needs to consider if this cost is worth the possibility of early repayment. Early repayment is also often referred to as early settlement and early redemption.

13.3.8 CURRENCY (RISK AND COST)

Loans and overdraft accounts are often offered in various currencies. Therefore, the company should also consider the currency of the loan. Taking up a loan in another currency than the currency in which the company is based, is risky. The risk associated with loans based in foreign currencies is that the repayment of the loan could increase if the currency rates changes in an unfavorable way. Of course, the currency could also change in a favorable way, causing repayment of the loan to drop.

Most companies consider taking up loan in foreign currencies because some currencies have lower interest rates. Thus, some companies are willing to risk unfavorable currency rate movements in exchange for lower interest rates. The lower interest rates come at a cost and that cost is the risk of unfavorable movements in the currencies rates (exchange rate).

13.3.9 LOAN TERMINATION AND LOAN GOVERNANCE

Most loan contracts with financial institutions contain conditions regulating termination of the loan. Termination of a loan is usually a right, owned and exercised by the financial institution, if certain events occur. The termination of a loan means that the company has to repay the remaining balance of the loan immediately. Events, which could lead to termination of the loan usually are:

- Default of the loan upon maturity of the payments
- Sale of assets pledged under mortgage
- Breakage of financial governance ratios.

Demand of immediate repayment of the remaining balance of the loan usually means bankruptcy of the company, which is why the financial institutions will, in most cases, try to resolve the issue before termination of the loan.

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14 AMORTIZATION OF LOANS

14.1 INTRODUCTION

Bank loans and bond loans can be amortized (or repaid) in different ways. There are 3 different generic ways of amortizing loans. Of course, combinations of these forms of amortization can be used. The 3 generic ways are:

- Standing loan (bullet loan)
- Serial loan
- Annuity loan

Example 28

> To illustrate the 3 different forms of amortization of loans, consider a loan with a nominal value of 1.000.000 and a nominal interest rate of 7% p.a. The loan is repaid over a period of 3 years in semi-annual payments.

The nominal value of a loan is the amount owed by the company to the lender. Thus, this is the amount being repaid by the company to the lender. In contrast to this are the proceeds from the loan. The proceeds from the loan is the amount actually being paid from the lender to the company, at the time of issue of the loan. The difference between the two amounts is due to the commission paid to the lender and the bond rate losses, if the loan is financed by issuing bonds. As amortization of the loan is on the basis of the nominal, we will revert to the calculation of proceeds in a later section.

14.2 STANDING LOAN (BULLET LOAN)

14.2.1 GENERAL CHARACTERISTICS

During the loan period of the standing loan, the company only pays interest. No repayment of the loan balance is paid. The payments remain constant, as the debt remains the same, until the loan expires. The last payment thus contains interest and the full balance of the loan.

14.2.2 AMORTIZATION OF A STANDING LOAN (BULLET LOAN)

Find below an amortization schedule of a standing loan based on the details given above.

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Amortization of a standing loan (bullet loan)

Interest per period 3,50%

Period	Balance begin	Payment	Interest	Repayment of loan	Balance end
1	1.000.000,00	35.000,00	35.000,00	0,00	1.000.000,00
2	1.000.000,00	35.000,00	35.000,00	0,00	1.000.000,00
3	1.000.000,00	35.000,00	35.000,00	0,00	1.000.000,00
4	1.000.000,00	35.000,00	35.000,00	0,00	1.000.000,00
5	1.000.000,00	35.000,00	35.000,00	0,00	1.000.000,00
6	1.000.000,00	1.035.000,00	35.000,00	1.000.000,00	0,00

Table 72

Notice that the number of periods is 6 while the repayment time is 3 years. This is because the loan is repaid in semi-annual payments. The loan is amortized over the total number of periods:

Formula 20

Total number of periods = repayment period in years * number of payments per year



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Thus, the total number of payments during the repayment period is:

Total number of periods = (3*2) = 6.

The begin balance in each period equals the end balance from the previous period:

Formula 21

Balance begin = Balance end (previous period)

In this case, there is no change until the last period since there is no repayment until then.

Interest is always calculated as interest percentage per period multiplied by the begin balance. The interest given in the example is a nominal interest rate of 7% p.a. Since the length of the period is 6 months, the nominal interest rate of 7% p.a. is converted to a 6 months' interest rate:

Formula 22

Interest rate per period = nominal interest rate p.a. / periods per year

Interest rate per period = 7% / 2 = 3,50%

The interest amount in the amortization table is calculated this way:

Formula 23

Interest amount per period = Interest rate per period * begin balance

Interest amount per period = 3,50% * 1.000.000 = 35.000

In general, the payment to the lender consists of interest and repayment of debt (settlement):

Formula 24

Payment per period = interest + repayment of debt

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As described earlier, a standing loan is not repaid during the loan period. Only interest is paid during the loan period. Except for the last period when the total balance of the loan is repaid together with the interest covering the current period. Thus, the payments for the 5 first periods only contain interest while Period 6 includes both interest and repayment of the balance.

Payment (Period 1–5 respectively) = 35.000 + 0 (repayment of debt) = 35.000

Payment (Period 6) = 35.000 + 1.000.000 = 1.035.000

14.3 SERIAL LOAN

14.3.1 GENERAL CHARACTERISTICS

Under a serial loan, the repayments (instalments) remain constant during the loan period. The interest amount included in the payment is however declining, as the interest amount is calculated on the basis of the declining loan balance. As a consequence of the constant repayments and the declining interest amount, the payment will decline during the loan period.

14.3.2 AMORTIZATION OF A SERIAL LOAN

Find below an amortization schedule of a serial loan based on the details given above.

Amortization of a serial loan

Interest per period 3,50%

Period	Balance begin	Payment	Interest	Repayment of loan	Balance end
1	1.000.000,00	201.666,67	35.000,00	166.666,67	833.333,33
2	833.333,33	195.833,33	29.166,67	166.666,67	666.666,67
3	666.666,67	190.000,00	23.333,33	166.666,67	500.000,00
4	500.000,00	184.166,67	17.500,00	166.666,67	333.333,33
5	333.333,33	178.333,33	11.666,67	166.666,67	166.666,67
6	166.666,67	172.500,00	5.833,33	166.666,67	0,00

Table 73

Notice that the number of periods is 6 while the repayment time is 3 years. This is because the loan is repaid in semi-annual payments. The loan is amortized over the total number of periods:

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Formula 25

Total number of periods = repayment period in years * number of payments per year

Thus, the total number of payments during the repayment period is:

Total number of periods = (3*2) = 6.

The repayment of the balance is calculated this way:

Formula 26

Repayment per period = Nominal loan / total number of periods

Repayment per period = 1.000.000 / 6 = 166.666,67

The end balance in each period is the begin balance less the repayment for the current period:

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Formula 27

End balance = Begin balance – repayment

End balance (Period 1) = 1.000.000 – 166.666,67 = 833.333,33

End balance (Period 2) = 833.333,33 – 166.666,67 = 666.666,67 (occur of rounding)

The begin balance in each period equals the end balance from the previous period:

Formula 28

Balance begin = Balance end (previous period)

Interest is always calculated as interest percentage per period multiplied by the begin balance. The interest given in the example is a nominal interest rate of 7% p.a. Since the length of the period is 6 months, the nominal interest rate of 7% p.a. is converted to a 6-month interest rate (semi-annual):

Formula 29

Interest rate per period = nominal interest rate p.a. / periods per year

Interest rate per period = 7% / 2 = 3,50%

The interest amount in the amortization schedule is calculated this way:

Formula 30

Interest amount per period = Interest rate per period * begin balance

Interest amount (Period 1) = 3,50% * 1.000.000 = 35.000

Interest amount (Period 2) = 3,50% * 833.333,33 =29.166,67

In general, the payment to the lender consists of interest and repayment of debt (settlement):

Formula 31

Payment per period = interest + repayment of debt

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As described earlier, under a serial loan, the repayments remain constant during the loan period while the interest amounts are declining. Thus, the payments are declining during the loan period.

Payment (Period 1) = 35.000 + 166.666,67 = 201.666,67

Payment (Period 2) = 29.166,67 + 166.666,67 = 195.833,33 (occur of rounding)

14.4 ANNUITY LOAN

14.4.1 GENERAL CHARACTERISTICS

Under an annuity loan the payments (interest and repayment) remain constant during the loan period. The interest amounts are decreasing during the loan period, while the repayments of the loan are increasing.

14.4.2 AMORTIZATION OF AN ANNUITY LOAN

Find below an amortization schedule of an annuity loan based on the details given above.

Calculation of annuity amount

Rate	3,50%
Nper	6
Pv	1.000.000,00
Fv	0
PMT =	-187.668,21

Amortization of a serial loan

Interest per period 3,50%

Period	Balance begin	Payment	Interest	Repayment of loan	Balance end
1	1.000.000,00	187.668,21	35.000,00	152.668,21	847.331,79
2	847.331,79	187.668,21	29.656,61	158.011,60	689.320,20
3	689.320,20	187.668,21	24.126,21	163.542,00	525.778,19
4	525.778,19	187.668,21	18.402,24	169.265,97	356.512,22
5	356.512,22	187.668,21	12.477,93	175.190,28	181.321,94
6	181.321,94	187.668,21	6.346,27	181.321,94	0,00

Table 74

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Notice that the number of periods is 6 while the repayment time is 3 years. This is because the loan is repaid in semi-annual payments. The loan is amortized over the total number of periods:

Formula 32

Total number of periods = repayment period in years * number of payments per year

Thus, the total number of payments during the repayment period is:

Total number of periods = (3*2) = 6.

The calculation of the annuity is done by using the Excel function "PMT", which returns a constant amount including interest covering the entered total number of periods. In this case, the payment per period is 187.668,21.

Interest is always calculated as interest percentage per period multiplied by the begin balance. The interest given in the example is a nominal interest rate of 7% p.a. Since the length of the period is 6 months, the nominal interest rate of 7% p.a. is converted to a 6-month interest rate (semi-annual):



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Formula 33

Interest rate per period = nominal interest rate p.a. / periods per year

Interest rate per period = 7% / 2 = 3,50%

The interest amount in the amortization schedule is calculated this way:

Formula 34

Interest amount per period = Interest rate per period * begin balance

Interest amount (Period 1) = 3,50% * 1.000.000 = 35.000

Interest amount (Period 2) = 3,50% * 847.331,79 =29.656,61

In general the payment to the lender consists of interest and repayment of debt (settlement):

Formula 35

Payment per period = interest + repayment of debt

In this case, the payment per period is known and the interest amount has just been calculated. To calculate the repayment the equation above is simply rearranged this way:

Formula 36

Repayment of debt = Payment per period – interest

As described earlier, under annuity loan, the interest amounts are decreasing while the repayments are increasing during the loan period.

Repayment of debt (Period 1) = 187.668,21 – 35.000 = 152.668,21

Repayment of debt (Period 2) = 187.668,21 – 29.656,61 = 158.011,60

The end balance in each period is the begin balance less the repayment for the current period:

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Formula 37

End balance = Begin balance – repayment

End balance (Period 1) = 1.000.000 – 152.668,21= 847.331,79

End balance (Period 2) = 847.331,79 – 158.011,60 = 689.320,20 (occur of rounding)

The begin balance in each period is the balance owed at the beginning of the period and equals the end balance from the previous period:

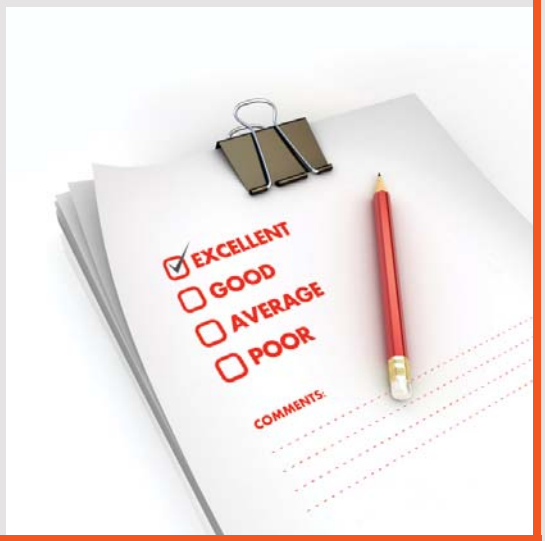
Formula 38

Balance begin = Balance end (previous period)

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15 EVALUATION OF LOANS

15.1 INTRODUCTION

This chapter concerns the evaluation of loan from an economic perspective. Thus, evaluation means cost measurement and comparison in this context.

As reviewed in Chapter 13.0 Financing Considerations, the cost of a loan is of course, one of the things a company has to consider when taking up a loan. However, the company cannot just simply look at the nominal interest rate on the loan agreement with the financial institution. The reason is that the nominal interest rate does not take commission cost, multi period interest compounding as well as bond loss (for bond loans only) into consideration.

In order for the company to review the cost of the loan and compare the cost of a loan to other loans, it needs a measure which includes commission costs, multi period interest compounding as well as bond loss (for bond loans only). Comparing nominal interest rates could potentially lead to wrong decisions by the company. Most companies would surely choose the cheapest loan given that all other relevant conditions are the same. However, choosing a low nominal interest rate loan with significant commission costs and bond loss over a loan with a higher nominal interest rate, low commission costs and no bond loss is, not necessarily, the cheapest loan.

In order to compare loans, most companies relay on the effective interest rate which includes all costs included in the loan. This measure of cost can often be reliable for comparison between loans.

In the following sections, the calculation of the effective interest rate on the following amortizations forms:

- Standing loan (bullet loan)
- Serial loan
- Annuity loan

Consider the following example which will be used to illustrate all 3 amortization forms:

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Example 29

A company is considering taking up a loan. The loan has a nominal value of 1.200.000 and a nominal interest rate of 7% p.a. The loan is repaid over a period of 3 years in semi-annual payments. The loan is based on bonds and the current bond rate is 94. Before paying the proceeds to the company, the financial institution deducts a commission cost of 50.000.

15.2 EVALUATION OF A STANDING LOAN (BULLET LOAN)

Based on Example 29 in Section 15.1, the effective interest rate for a standing loan is calculated as the internal interest rate (IRR) on the loan. The amounts needed for this calculation are the payments and the proceeds from the loan.

Before turning to the actual calculations of the effective interest rate, the proceeds from the loan need to be calculated. Find below the calculated proceeds from the loan:

Calculation of proceeds from a bond loan	
Nominal value	1.200.000,00
Bond rate	94,00
Market value	1.128.000,00
Commission costs	-50.000,00
Proceeds	**1.078.000,00**

Table 75

Next, the payments of the loan are calculated:

Amortization of a standing loan (bullet loan)

Interest per period 3,50%

Period	Balance begin	Payment	Interest	Repayment of loan	Balance end
1	1.200.000,00	42.000,00	42.000,00	0,00	1.200.000,00
2	1.200.000,00	42.000,00	42.000,00	0,00	1.200.000,00
3	1.200.000,00	42.000,00	42.000,00	0,00	1.200.000,00
4	1.200.000,00	42.000,00	42.000,00	0,00	1.200.000,00
5	1.200.000,00	42.000,00	42.000,00	0,00	1.200.000,00
6	1.200.000,00	1.242.000,00	42.000,00	1.200.000,00	0,00

Table 76

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Finally, the effective interest rate can be calculated for the loan:

Effective interest rate on standing loan	
Period	**Payment**
0	1.078.000,00
1	-42.000,00
2	-42.000,00
3	-42.000,00
4	-42.000,00
5	-42.000,00
6	-1.242.000,00
IRR per period	5,5376%
IRR p.a.	11,3818%

Table 77

The reason for the proceeds to be included, instead of the calculation of the effective interest rate, is that both the bond rate loss and the commission costs need to be included. By using the proceeds, these costs are included in the effective interest rate. The nominal interest rate on the loan is 7% p.a., while the effective interest rate is 11.38% p.a. The difference in the two figures are due to:

- Compounding interest
- Commission costs
- Bond rate loss

Which are all included in the effective interest rate.

The "IRR" formula in Excel is used to calculate the IRR per period (the effective interest rate per period). However, to include the compounding of interest into the effective interest rate, the IRR per period needs to be converted into an effective interest rate p.a. This is done by using the following formula:

Formula 39

$$(1+\text{IRR per period})^{\wedge\text{periods per year}} - 1$$

$$(1+0{,}055376)^{\wedge 2}-1 = 0{,}113818 = 11{,}38\%$$

The total annual cost of the loan is thus 11,38% p.a.

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15.3 EVALUATION OF A SERIAL LOAN

Based on Example 29 in Section 15.1, the effective interest rate for a serial loan is calculated as the internal interest rate (IRR) on the loan. The amounts needed for this calculation are the payments and the proceeds from the loan.

Before turning to the actual calculations of the effective interest rate, the proceeds from the loan need to be calculated. Find below the calculated proceeds from the loan:

Calculation of proceeds from a bond loan	
Nominal value	1.200.000,00
Bond rate	94,00
Market value	1.128.000,00
Commission costs	-50.000,00
Proceeds	**1.078.000,00**

Table 78



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Next, the payments of the loan are calculated:

Amortization of a serial loan

Interest per period 3,50%

Period	Balance begin	Payment	Interest	Repayment of loan	Balance end
1	1.200.000,00	242.000,00	42.000,00	200.000,00	1.000.000,00
2	1.000.000,00	235.000,00	35.000,00	200.000,00	800.000,00
3	800.000,00	228.000,00	28.000,00	200.000,00	600.000,00
4	600.000,00	221.000,00	21.000,00	200.000,00	400.000,00
5	400.000,00	214.000,00	14.000,00	200.000,00	200.000,00
6	200.000,00	207.000,00	7.000,00	200.000,00	0,00

Table 79

Finally, the effective interest rate can be calculated for the loan:

Effective interest rate on serial loan

Period	Payment
0	1.078.000,00
1	-242.000,00
2	-235.000,00
3	-228.000,00
4	-221.000,00
5	-214.000,00
6	-207.000,00
IRR per period	6,9584%
IRR p.a.	14,4010%

Table 80

The reason for the proceeds to be included, instead of the calculation of the effective interest rate, is that both the bond rate loss and the commission costs need to be included. By using the proceeds, these costs are included in the effective interest rate. The nominal interest rate on the loan is 7% p.a., while the effective interest rate is 14.40% p.a. The difference in the two figures are due to:

- Compounding interest
- Commission costs
- Bond rate loss

Which are all included in the effective interest rate.

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The "IRR" formula in Excel is used to calculate the IRR per period (the effective interest rate per period). However, to include the compounding of interest into the effective interest rate, the IRR per period needs to be converted into an effective interest rate p.a. This is done by using the following formula:

Formula 40

$$(1+\text{IRR per period})^{\wedge \text{periods per year}} - 1$$

$$(1+0{,}069584)^{\wedge 2}-1 = 0{,}144010 = 14{,}40\%$$

The total annual cost of the loan is thus 14,40% p.a.

15.4 EVALUATION OF AN ANNUITY LOAN

Based on Example 29 in Section 15.1 the effective interest rate for an annuity loan is calculated as the internal interest rate (IRR) on the loan. The amounts needed for this calculation are the payments and the proceeds from the loan.

Before turning to the actual calculations of the effective interest rate, the proceeds from the loan need to be calculated. Find below the calculated proceeds from the loan:

Calculation of proceeds from a bond loan	
Nominal value	1.200.000,00
Bond rate	94,00
Market value	1.128.000,00
Commission costs	-50.000,00
Proceeds	**1.078.000,00**

Table 81

Next, the payments of the loan are calculated:

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Calculation of annuity amount

Rate	3,50%
Nper	6
Pv	1.200.000,00
Fv	0
PMT =	-225.201,85

Amortization of a serial loan

Interest per period 3,50%

Period	Balance begin	Payment	Interest	Repayment of loan	Balance end
1	1.200.000,00	225.201,85	42.000,00	183.201,85	1.016.798,15
2	1.016.798,15	225.201,85	35.587,94	189.613,92	827.184,23
3	827.184,23	225.201,85	28.951,45	196.250,40	630.933,83
4	630.933,83	225.201,85	22.082,68	203.119,17	427.814,67
5	427.814,67	225.201,85	14.973,51	210.228,34	217.586,33
6	217.586,33	225.201,85	7.615,52	217.586,33	0,00

Table 82

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Finally, the effective interest rate can be calculated for the loan:

Effective interest rate on annuity loan	
Period	**Payment**
0	1.078.000,00
1	-225.201,85
2	-225.201,85
3	-225.201,85
4	-225.201,85
5	-225.201,85
6	-225.201,85
IRR per period	6,8627%
IRR p.a.	14,1963%

Table 83

The reason for the proceeds to be included, instead of the calculation of the effective interest rate, is that both the bond rate loss and the commission costs need to be included. By using the proceeds, these costs are included in the effective interest rate. The nominal interest rate on the loan is 7% p.a., while the effective interest rate is 14.20% p.a. The difference in the two figures are due to:

- Compounding interest
- Commission costs
- Bond rate loss

Which are all included in the effective interest rate.

The "IRR" formula in Excel is used to calculate the IRR per period (the effective interest rate per period). However, to include the compounding of interest into the effective interest rate, the IRR per period needs to be converted into an effective interest rate p.a. This is done by using the following formula:

Formula 41

$$(1+\text{IRR per period})^{\wedge\text{periods per year}} - 1$$

$$(1+0{,}068627)^{\wedge 2}-1 = 0{,}141963 = 14{,}20\%$$

The total annual cost of the loan is thus 14,20% p.a.

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15.5 EVALUATION LOANS – OVERVIEW

Find below an overview of the results of the calculations from Section 15.2, 15.3 and 15.4:

Results of calculations of effective interest rates:		
	Nominal interest rate	**Effective interest rate**
Standing loan (bullet loan)	7%	11,38%
Serial loan	7%	14,40%
Annuity loan	7%	14,20%

Table 84

Recall that initially the loans all had the same nominal interest rate of 7% p.a. Taking the following into consideration:

- Difference in payment pattern
- Compounding interest
- Commission costs
- Bond rate loss

has changed the picture. First of all, it is clear that the cost of all the loans are significantly higher than the nominal interest rate. Second, the difference in payment patterns has also impacted the effective interest rates. The lowest effective interest rate is the standing loan, while the highest effective interest rate is the annuity loan. So, if the company is only interested in the cost of the loan, it would choose the standing loan since the effective interest rate is only 11,38% p.a. However, as you might recall from Chapter 13.0 Financing considerations, cost is not the only thing the company should consider when taking up a loan. Other factors include risk, flexibility and liquidity.

It is tempting to conclude that the ranking of cost on loans given above is always applicable. However, the conclusion is not generic. The conclusion only applies if:

- The proceeds from the compared loans are the same
- The loan period of the compared loan is the same.

If this is not the case, the effective interest rate is not the best basis for comparison of loans.

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16 EVALUATION OF OTHER CREDIT

16.1 INTRODUCTION

In this chapter, other credit will be reviewed. Other credit includes:

- Overdraft accounts (non-scheduled amortization)
- Trade creditors

These are both used in everyday life in a company. But as discussed earlier, the cost of using a credit should be evaluated so the company knows if the credit is the best form of finance.

16.2 OVERDRAFT ACCOUNTS (NON-SCHEDULED AMORTIZATION)

An overdraft account is usually an account where the company can withdraw money whenever it needs it. There is usually a prefixed maximum balance that the overdraft can reach. Within the fixed limit, the company can freely withdraw and deposit money whenever it has the need. There is no predetermined amortization attached to the overdraft account and, usually, no agreed loan period either. The overdraft account usually applies until cancelled by either the financial institution or the company.



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Consider the following example to illustrate the calculation of the effective interest rate for an overdraft account:

Example 30

A company is considering opening an overdraft account with a financial institution. The financial institution offers the company an overdraft maximum of 1.200.000 and interest on the overdraft of nominal 9% p.a. The financial institution charges 1% in commission p.a. on the maximum overdraft. Both interest and commission are calculated semi-annually. The company estimates that the overdraft account will have an average overdraft of 1.080.000 during a year.

To calculate the effective interest rate using the following formula:

Formula 42

$$((1+\text{interest rate per period}) + (\text{commission per period/utilization}))^{\text{number of periods per year}} - 1$$

Formula 43

Where interest rate per period is:

Nominal interest rate per year / number of interest calculations per year

9% / 2 = 4,5%

Formula 44

Where commission per period is:

Commission per year / number of commission calculations per year

1% / 2 =0,5%

Formula 45

Where utilization is:

Average overdraft balance / maximum overdraft

1.080.000 / 1.200.000 =0,9

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Which are used to calculate the effective interest rate of the overdraft account

((1+interest rate per period) + (commission per period/utilization))^number of periods per year – 1

((1+0,045)+(0,005/0,9))^2 – 1 = 0,1037 = 10,37% p.a.

This effective interest rate includes:

- Commission cost
- Compounding interest

Which means that all costs have been included in the effective interest rate.

Now, consider what happens if the company expects an average overdraft balance equal to the maximum balance of the overdraft account.

Example 31

A company is considering opening an overdraft account with a financial institution. The financial institution offers the company an overdraft maximum of 1.200.000 and interest of the overdraft on nominal 9% p.a. The financial institution charges 1% in commission p.a. on the maximum overdraft. Both interest and commission are calculated semi-annually. The company estimates that the overdraft account will have an average overdraft of 1.200.000 during a year.

To calculate the effective interest rate using the following formula:

Formula 46

((1+interest rate per period) + (commission per period/utilization))^number of periods per year – 1

Formula 47

Where interest rate per period is:

Nominal interest rate per year / number of interest calculations per year

9% / 2 = 4,5%

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Formula 48

Where commission per period is:

Commission per year / number of commission calculations per year

1% / 2 =0,5%

Formula 49

Where utilization is:

Average overdraft balance / maximum overdraft

1.200.000 / 1.200.000 =1,0

Which are used to calculate the effective interest rate of the overdraft account

((1+interest rate per period) + (commission per period/utilization))^number of periods per year – 1

((1+0,045)+(0,005/1,0))^2 – 1 = 0,1025 = 10,25% p.a.



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This effective interest rate still includes:

- Commission cost
- Compounding interest

Which means that all costs have been included in the effective interest rate.

Compared to the previous example the effective interest rate is lower. The reason for this is that the commission is charged on the maximum and not the actual overdraft balance. The conclusion is that the lowest effective interest rate is obtained by always utilizing the maximum of the overdraft account, when commission is charged on the maximum.

16.3 TRADE CREDITORS

In connection with purchases from its suppliers (trade creditors), the company is often offered different payment terms. The example below illustrates the choices the company faces:

Example 32

A company is offered the following payment terms by its supplier:

- Payment: 8 days less 2% or
- Payment: 3,5 months net

The company pays an effective interest rate of 9% p.a. on its overdraft account.

The company now has to decide when to pay the supplier. Should it pay the supplier on Day 8 and receive a discount of 2% for early settlement or should it wait an additional 97 days (3,5 months of 30 days less 8 days = 97 days)?

The first 8 days are free of charge and should be used no matter what. The basic decision for the company is to pay either on Day 8 or 97 days later on Day 105. The company needs to calculate how much it would cost to utilize the extra 97 days of credit. See the calculations below:

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Calculation of interest per period:	
Using "Rate" in excel:	
Nper	1
Pmt	0
Pv	98
Fv	-100
Rate	**2,0408%**

Table 85

This interest per period is converted to an effective interest rate using the following formula:

Formula 50

$$(1+ \text{interest per period})^{\text{number of periods}} - 1$$

$$(1+ 0{,}020408)^{(360/97)} - 1 = 0{,}0779 = 7{,}79\% \text{ p.a.}$$

The conclusion is that since the extra 97 days of credit only cost 7,79% p.a. the company should pay the supplier 3,5 or on Day 105.

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17 FINANCIAL PLANNING

17.1 INTRODUCTION

Until now, we have kept apart considerations and calculations regarding investments and financing. Now it is time to bring the two areas together.

17.2 FINDING THE RIGHT FINANCING PACKAGE

Consider the following example to illustrate the necessity of financial planning and finding the right financing package.

Example 33

A company has, for some, time been considering investing in a new business activity. The company has evaluated the considered investment according to the methods introduced during the investment part of this book. Find below the evaluation of the investment using the net present value method:

Period	Investment	Earnings	Net cash flow
0	-4.000.000,00		-4.000.000,00
1		800.000,00	800.000,00
2		950.000,00	950.000,00
3		1.200.000,00	1.200.000,00
4		1.400.000,00	1.400.000,00
5		1.500.000,00	1.500.000,00
	Net present value		301.575,28

Table 86

First of all, it is worth noting that the net present value of the investment is positive (using a discount rate of 10% p.a.). There is, of course, no use in starting financial planning if the investment project had a negative net present value. If that had been the case, the investment should have been rejected.

The company has been offered the following financing package from its bank:

- 4-year annuity bond loan with annual payments
- Nominal value (face value) = 4.000.000
- Bond rate = 98
- Annual interest rate = 7% p.a.
- Commission costs = 1% of market value

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The offer from the bank has the following proceeds:

Calculation of proceeds from a bond loan	
Nominal value	4.000.000,00
Bond rate	98,00
Market value	3.920.000,00
Commission costs	-39.200,00
Proceeds	**3.880.800,00**

Table 87

While the annual payment on the loan can be calculated as follows:

Calculation of annuity amount	
Rate	7,00%
Nper	4
Pv	4.000.000,00
Fv	0
PMT =	-1.180.912,47

Table 88

The first thing the company should notice is that the proceeds from the loan cannot cover the initial investment of 4.000.000 in the investment project. The financing gap is (3.880.800 – 4.000.000) = -119.200. The company is thus short of 119.200 provided that it wants 100% financing from the bank.

Next, consider the following illustration of the cash flow from the investment, together with the required cash-flow for servicing the loan (annuity payments):

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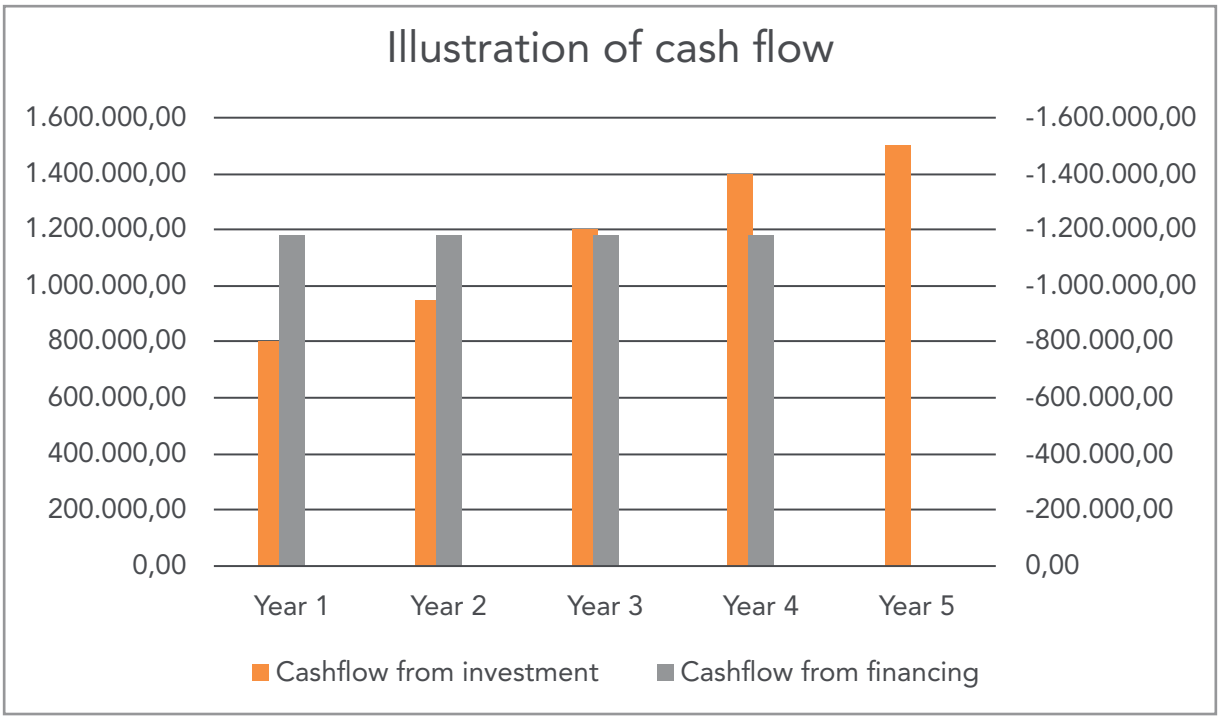


Table 89

The company should notice that the cash flow from the investment falls short of the required cash-flow for servicing the loan in Year 1 and Year 2. This creates a further need for financing, which should be considered before the investment is launched.

Before going ahead with the project, the company needs to ensure financing of the gap between the initial investment and the proceeds from the loan. Further, the company needs to ensure that the financing gap in Year 1 and Year 2 can be closed. There are numerous ways to close the before mentioned gaps. The company could try and negotiate a higher face value of the loan to ensure that it can actually make the initial investment. Or it could try and negotiate a credit facility, which can also be used for covering the financing gaps in Year 1 and Year 2. An overdraft account could be a solution to the latter suggestion. Finally, the company could also try to negotiate for a 5-year repayment period instead of a 4-year period on the loan.

Let us try and continue the previous example to illustrate a possible solution.

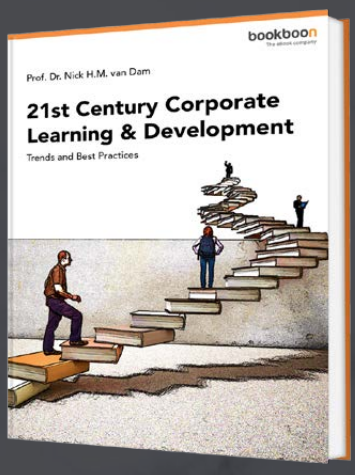
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Example 34 (based on Example 33 above)

The company has been in contact with its bank. The bank has offered the company an overdraft account with a maximum of 200.000. Further, the bank has agreed to extend the repayment period from 4 to 5 years.

Calculation of annuity amount	
Rate	7,00%
Nper	5
Pv	4.000.000,00
Fv	0
PMT =	-975.562,78

Table 90

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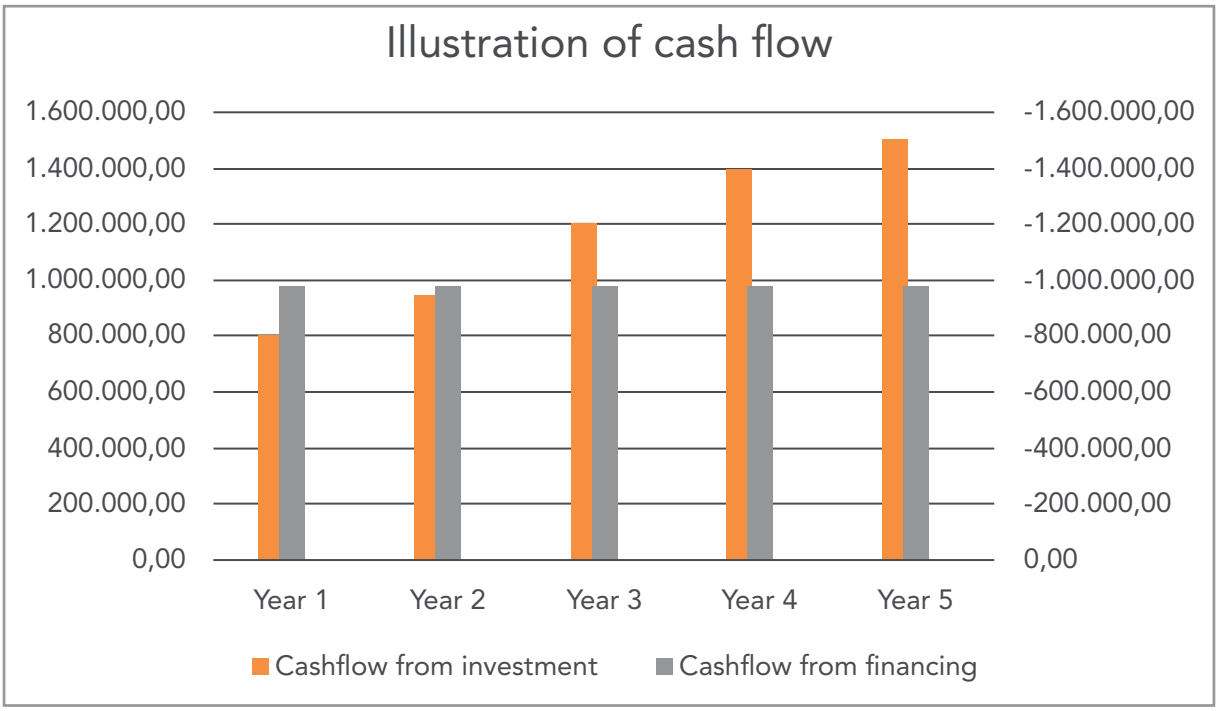


Table 91

From the illustration above, the company should notice that the cash flow from the investment falls short of the required cash-flow for servicing the loan in Year 1 and Year 2. Below, the movements and the balance on the overdraft account are illustrated.

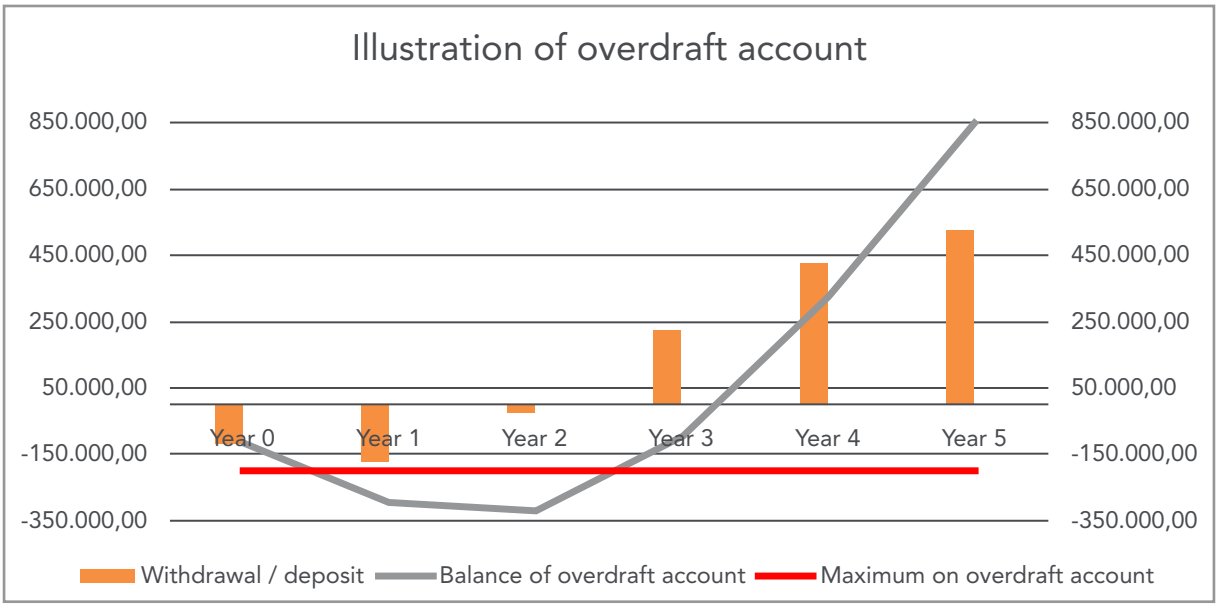


Table 92

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As it can be seen from the illustration above, the balance of the overdraft account is over the agreed maximum when taking the initial financing gap of 119.200 into consideration. The calculations behind the illustration do, furthermore, not take either commission cost or interest on the overdraft account into consideration. Overall, the offered financing package does not meet the needs of the company.

Based on the illustrations above, the company contacts its bank again for a better financing package.

Example 35 (based on Example 34 above)

After some renegotiation, the bank now offers the company the following financing package:

- 5-year bond loan with annual payments
- 60% of the loan (nominal value) is repaid as an annuity loan while the remaining part is repaid as a standing loan
- Total nominal value = 4.000.000
- Bond rate = 98 (both annuity and standing loan)
- Annual interest rate = 7% p.a. on the annuity loan
- Annual interest rate = 8,5% p.a. on the standing loan
- Commission costs = 1% of market value
- An overdraft account with a maximum of 200.000.

Calculation of annuity amount	
Rate	7,00%
Nper	5
Pv	2.400.000,00
Fv	0
PMT =	-585.337,67

Table 93

The payment of the standing loan is the interest only, until the final year of the loan when the balance of the loan is repaid. Thus, in Year 1-4 the payment of the standing loan is (8,5% of 1.600.000) = 136.000. In Year 5 the payment is (1.600.000 + 136.000) = 1.736.000.

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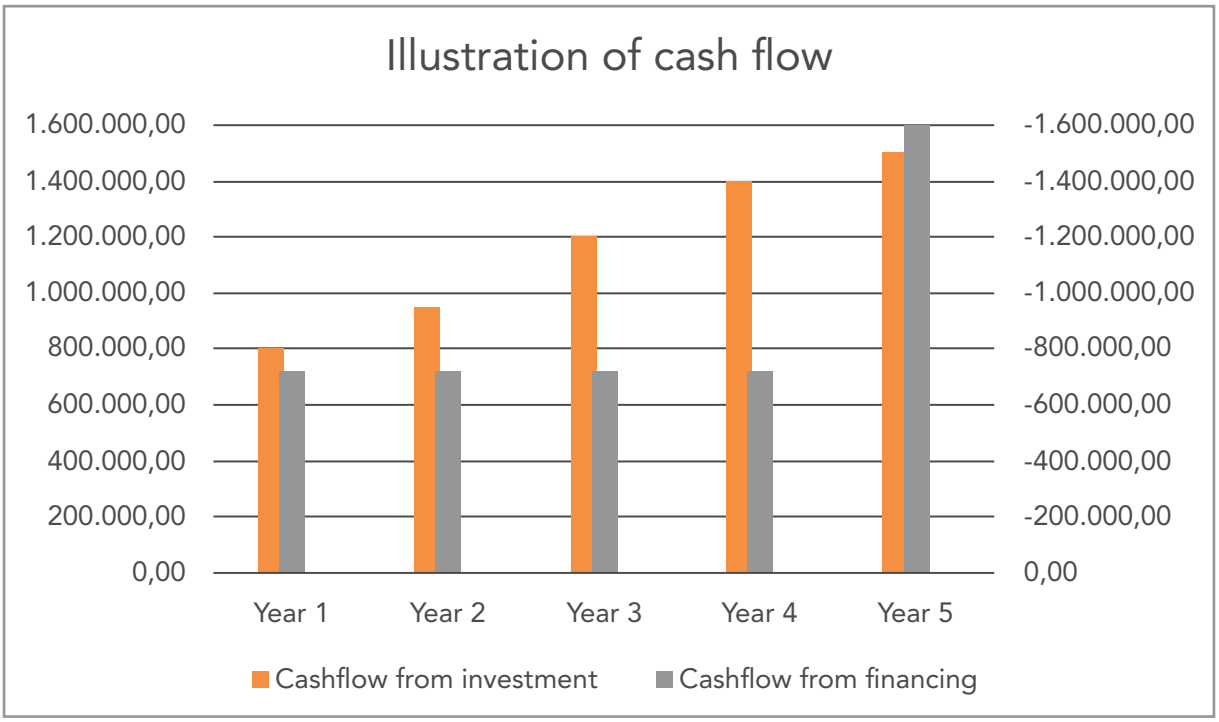


Table 94



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The illustration above shows that there is a cash flow surplus in Year 1-Year 4 as the cash-flow from investment more than covers the required cash-flow for servicing the loans. However, in Year 5, the cash-flow from the investment falls short of the needed cash flow for servicing the loans. This does, however, not cause a problem which can be seen from the illustration of the overdraft account below:

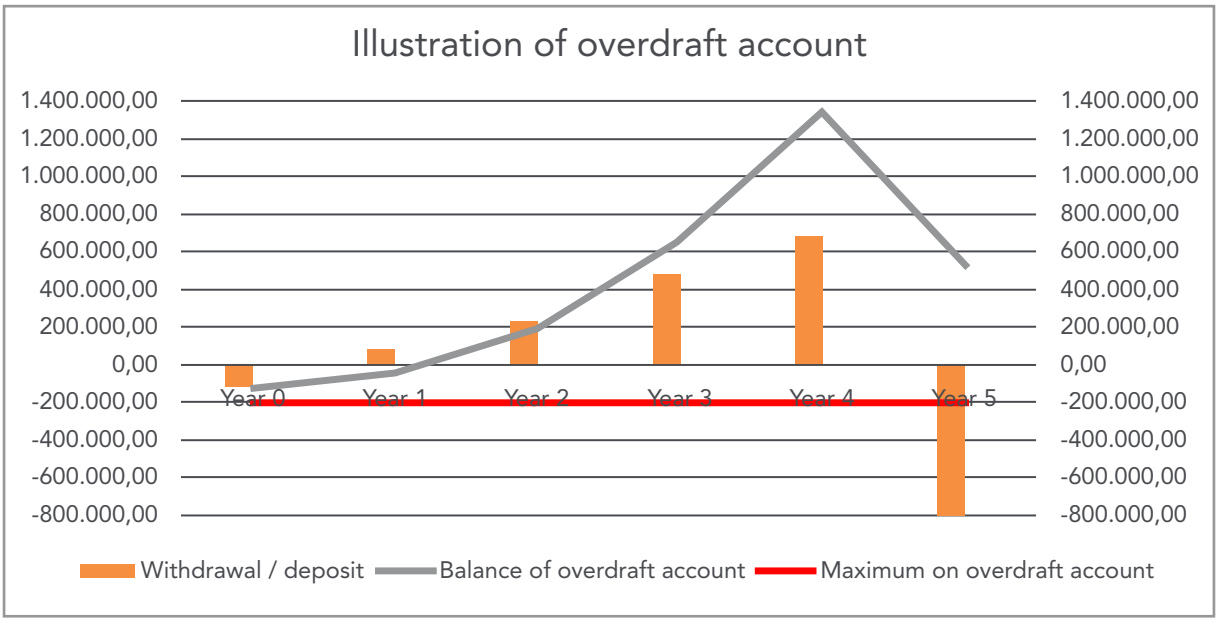


Table 95

The repayment of the standing loan in Year 5 causes a large withdrawal from the overdraft account. This withdrawal is, however, absorbed by the carried forward balance for previous years and, thus, causes no problem.

The company has now found a financing package which fits its needs. The company has, however, not taken the cost of the financing package into consideration.

17.3 EVALUATION OF COST OF THE FINANCIAL PACKAGE

Until now, we have concentrated our effort on bridging the cash-flow from the investment with the cash flow needed to service the financing. We have not considered the cost of the financing package presented. This will be done in the following by calculating the effective interest rate for the total financing packages.

Below the packages are recaptured:

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Package 1	Package 2	Package 3
• 4-year annuity bond loan with annual payments • Nominal value (face value) = 4.000.000 • Bond rate = 98 • Annual interest rate = 7% p.a. • Commission costs = 1% of market value.	• 5-year annuity bond loan with annual payments • Nominal value (face value) = 4.000.000 • Bond rate = 98 • Annual interest rate = 7% p.a. • Commission costs = 1% of market value • An overdraft account with a maximum of 400.000. **This is higher than the original offered since the original maximum was not adequate.** • Interest on overdraft account is 12% nominal per year. • Commission cost of maximum on overdraft is 1,5% per year. The commission is prepaid.	• 5-year bond loan with annual payments • 60% of the loan (nominal value) is repaid as an annuity loan while the remaining part is repaid as a standing loan • Total nominal value = 4.000.000 • Bond rate = 98 (both annuity and standing loan) • Annual interest rate = 7% p.a. on the annuity loan • Annual interest rate = 8,5% p.a. on the standing loan • Commission costs = 1% of market value • An overdraft account with a maximum of 200.000. • Interest on overdraft account is 12% nominal per year. • Commission cost of maximum on overdraft is 1,5% per year. The commission is prepaid.

Table 96

17.3.1 EVALUATION OF FINANCING PACKAGE 1

Recall from earlier, the following calculation of the proceeds and the annuity payment from the offered loan:

- Proceeds = 3.880.800
- Annuity payment per year = 1.180.912,47

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The calculation of the effective interest rate on an annuity loan was reviewed in Chapter 15.0 Evaluation of loans. Find below the calculation of the effective interest rate for Financing Package 1:

Effective interest rate on annuity loan	
Period	**Payment**
0	3.880.800,00
1	-1.180.912,47
2	-1.180.912,47
3	-1.180.912,47
4	-1.180.912,47
IRR p.a.	8,3529%

Table 97

The effective interest rate is 8,3529% p.a. on Financing Package 1.



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17.3.2 EVALUATION OF FINANCING PACKAGE 2

Recall from earlier, the following calculation of the proceeds and the annuity payment from the offered loan:

- Proceeds = 3.880.800
- Annuity payment per year = 975.563,78

Recall from Example 34 that to cover the initial investment of 4.000.000 an amount of 119.200 was withdrawn from the overdraft account in Year 0.

Find below the calculation of the effective interest rate for Financing Package 2:

Calculation of effective interest rate						
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cash flow from investment	0,00	800.000,00	950.000,00	1.200.000,00	1.400.000,00	1.500.000,00
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Overdraft balance begin	0,00	125.200,00	321.786,78	391.963,97	220.562,43	0,00
Withdrawal / deposit	119.200,00	175.562,78	25.562,78	-224.437,22	-253.029,92	-6.000,00
Commission	6.000,00	6.000,00	6.000,00	6.000,00	6.000,00	6.000,00
Interest		15.024,00	38.614,41	47.035,68	26.467,49	0,00
Overdraft balance end	125.200,00	321.786,78	391.963,97	220.562,43	0,00	0,00
Unallocated cash flow		0,00	0,00	0,00	171.407,30	518.437,22
Unallocated cash flow - accumulated		0,00	0,00	0,00	171.407,30	689.844,52
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Overdraft account	119.200,00	175.562,78	25.562,78	-224.437,22	-253.029,92	-6.000,00
Proceeds from loan	3.880.800,00					
Annuity loan		-975.562,78	-975.562,78	-975.562,78	-975.562,78	-975.562,78
Net payment on financing	4.000.000,00	-800.000,00	-950.000,00	-1.200.000,00	-1.228.592,70	-981.562,78
Effective interest rate p.a.	**8,7102%**					

Table 98

The effective interest rate is 8,7102% p.a. on Financing Package 2 based on "Net payment on financing". Note that the sign on the overdraft account has been switched. Positive balance amounts mean that the company owes money.

The calculation of the effective interest rate with multiple financing sources is a bit difficult. Recall from Chapter 15.0 Evaluation of loans, that in order to calculate the effective interest rate, the proceeds from a loan are only matched with payments on that particular loan. Also, recall that payment equals repayment amount, plus interest amount.

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This principle is also used in the calculation of the effective interest rate above. First, the development in the interest bearing balance on the overdraft account is calculated. Provision is calculated on the maximum of 400.000 and prepaid. Interest is calculated on the begin balance every year. This is assumed correct as withdrawals and deposits on the account only occur at the end of the year and, thus, do not affect the interest calculation.

The withdrawal or deposit to the account is calculated the following way:

Formula 51

Overdraft account = -(Annuity loan) + (Net payment on financing)

However, the result from the formula only applies as long as the balance on the overdraft account does not turn negative, in the case of a deposit. It can only be zero.

Consider the following to illustrate the above:

Overdraft account = -(Annuity loan) + (Net payment on financing)

Year 1 = Overdraft account = -(-975.562,78) + (-800.000) = 175.562,78

Year 2 = Overdraft account = -(-975.562,78) + (-950.000) = 25.562,78

Year 3 = Overdraft account = -(-975.562,78) + (-1.200.000) =

-224.437,22

Year 4 = Overdraft account = -(-975.562,78) + (-1.400.000) =

-424.437,30, however this amount would cause the balance of the overdraft account to become negative. Hence, in order for the overdraft account not to become negative the deposit is reduced to 253.029,92, thus, leaving an unallocated cash-flow of 171.407,30.

Year 5 = Overdraft account = -(-975.562,78) + (-1.500.000) =

-524.437,22, however this amount would cause the balance of the overdraft account to become negative. Hence, in order for the overdraft account not to become negative the deposit is reduced to 6.000 thus leaving an unallocated cash-flow of 518.437,22.

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The reason for not depositing the unallocated cash flow to the overdraft account is that this would influence the calculation of the effective interest rate. In fact, it would reduce the effective interest rate, since the calculation would have been influenced by cash-flow not needed to repay the borrowing itself nor interest or commission.

17.3.3 EVALUATION OF FINANCING PACKAGE 3

Recall from earlier, the following calculation of the proceeds and the annuity payment from the offered loan:

- Proceeds = 3.880.800
- Annuity payment per year = 585.563,78
- Payment on standing loan per year = 136.000 except for the final year where the payment is 1.736.000.

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Recall from Example 35, that in order to cover the initial investment of 4.000.000 an amount of 119.200 was withdrawn from the overdraft account in Year 0.

Find below the calculation of the effective interest rate for Financing Package 3:

Calculation of effective interest rate						
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cash flow from investment	0,00	800.000,00	950.000,00	1.200.000,00	1.400.000,00	1.500.000,00
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Overdraft balance begin	0,00	122.200,00	61.201,67	0,00	0,00	0,00
Withdrawal / deposit	119.200,00	-78.662,33	-71.545,87	-3.000,00	-3.000,00	-3.000,00
Commission	3.000,00	3.000,00	3.000,00	3.000,00	3.000,00	3.000,00
Interest		14.664,00	7.344,20	0,00	0,00	0,00
Overdraft balance end	122.200,00	61.201,67	0,00	0,00	0,00	0,00
Unallocated cash flow		0,00	157.116,46	475.662,33	675.662,33	-824.337,67
Unallocated cash flow - accumulated		0,00	157.116,46	632.778,79	1.308.441,12	484.103,45
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Overdraft account	119.200,00	-78.662,33	-71.545,87	-3.000,00	-3.000,00	-3.000,00
Proceeds from loan	3.880.800,00					
Standing loan	0,00	-136.000,00	-136.000,00	-136.000,00	-136.000,00	-1.736.000,00
Annuity loan	0,00	-585.337,67	-585.337,67	-585.337,67	-585.337,67	-585.337,67
Net payment on financing	4.000.000,00	-800.000,00	-792.883,54	-724.337,67	-724.337,67	-2.324.337,67
Effective interest rate p.a.	**8,8732%**					

Table 99

The effective interest rate is 8,8732% p.a. on Financing Package 3 based on "Net payment on financing". The calculations on withdrawals / deposits are identical to those for Financing Package 2.

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17.3.4 CONCLUSION OF EVALUATION OF FINANCING PACKAGES

Recapturing the effective interest for all 3 financing packages, the following can be seen:

	Package 1	Package 2	Package 3
Details	• 4-year annuity bond loan with annual payments.	• 5-year annuity bond loan with annual payments • An overdraft account with a maximum of 400.000.	• 5-year bond loan with annual payments • 60% of the loan (nominal value) is repaid as an annuity loan while the remaining part is repaid as a standing loan • An overdraft account with a maximum of 200.000.
Flexibility	Low degree of flexibility	Some degree of flexibility	Higher degree of flexibility
Effective interest rate	8,3529% p.a.	8,7102% p.a.	8,8732% p.a.

Table 100

The result from the evaluation of the 3 packages is that the higher the degree of flexibility, the higher the effective interest rate. The conclusion is that if the company is very unsure of the cash flow from the investment, it needs to built-in flexibility in the financing package. The flexibility comes at a cost, and that cost is a higher effective interest rate on the total financing package.

The company needs to consider the flexibility of the financing should the cash-flow from the investment not be as planned. The cash flow from the investment could arrive later or it could arrive earlier. Should the cash-flow from the investment come earlier, it is usually not a big problem. The cash-flow can be placed in a deposit account awaiting the servicing of the financing. If the company feels confident that the entire cash flow from the investment will arrive earlier then it could try to pre settle the financing. Some banks allow this in their contracts. The company should, in general, try and negotiate for such pre settlement rights before the financing package is agreed and signed. Afterwards, it can be hard to negotiate for such pre settlement rights.

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On the other hand, cash flow from the investment can also arrive late. This is usually a worse situation. Potentially, it could mean that the company is not able to pay its loan on time causing it to default on the loan. This could potentially lead to bankruptcy. Clearly, this is not a desirable situation for the company. However, it should be noted that it is usually not a desirable situation for the bank either. In these cases, banks often do recover all of its lending to the company, causing a loss.

17.4 OTHER CONSIDERATIONS

In return for financing banks often have further demands on the company. Such demands often include the following:

- Investors have to increase the capital in the company to reduce the risk of the bank.
- Investors have to provide loans to the company to reduce the risk of the bank. Often banks will demand that repayment of loans provided by investors cannot be repaid (or only to some extend), before a substantial part of the loan, provided by the bank, has been repaid.
- The company cannot pay any dividend to its shareholders until X% of the loan is repaid.
- The company cannot pay any dividend to its shareholders until the balance of the overdraft account is below X% of the maximum.
- The company cannot take up any new loans before 50% of the loan has been repaid.
- The solutions are numerous and the suggestions above not exhaustive.

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EXERCISES

Solutions for all exercises can be following this link: http://www.proprofs.com/training/course/?title=introduction-to-investment-and-finance-solutions-exercises

EXERCISES FOR CHAPTER 1.0

Exercise 1.1

A company is considering buying a new machine at a price of 1.500.000. This machine is expected to be used for the next 6 years, after which it is expected to be sold for an amount of 20.000. The earnings from the Investment are expected to be 280.000 on an annual basis. The investment horizon is set at 6 years. The interest rate is set at 10% p.a.

Question 1
Calculate the balance of the overdraft account in accordance with example 2 in chapter 1 (table 1).



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Question 2
Calculate the balance of the overdraft account in accordance with example 2 in chapter 1 (table 2).

Question 3
Calculate the interest rate which would give a balance of 0 at the end of the investment horizon.

Exercise 1.2

A company is considering buying a new machine at a price of 2.000.000. This machine is expected to be used for the next 5 years, after which it is expected to be sold for an amount of 120.000.

The earnings from the investment are expected to be 250.000 in year 1, 300.000 in year 2, 500.000 in year 3, 600.000 in year 4 and 680.000 in year 5. The Investment horizon is set at 5 years. The interest rate is set at 14% p.a.

Question 1
Calculate the balance of the overdraft account in accordance with example 2 in chapter 1 (table 1).

Question 2
Calculate the balance of the overdraft account in accordance with example 2 in chapter 1 (table 2).

Question 3
Calculate the interest rate which would give a balance of 0 at the end of the investment horizon.

EXERCISES FOR CHAPTER 3.0

Exercise 3.1

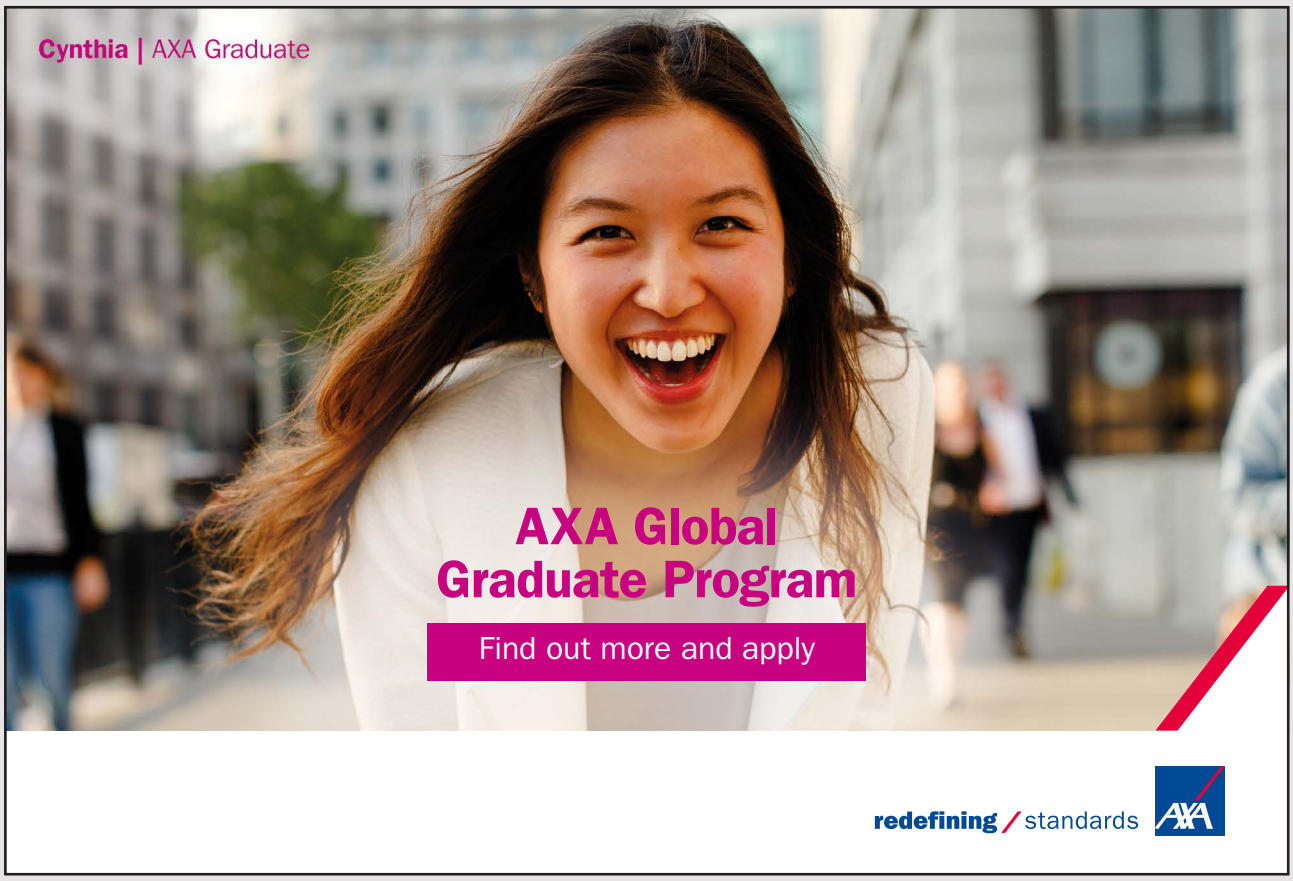
A company is looking into investing in new business activity. If it goes ahead it needs to invest in a machine with a price of 800.000 and a reselling price (residual value) after 6 years of 50.000. The company uses a discount rate of 12% p.a. in evaluating investment decisions.

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The expected earnings (cash result before depreciation) for the coming 6 periods (years) can be found below:

Period	Earnings
1	100.000
2	190.000
3	300.000
4	200.000
5	100.000
6	90.000

Question 1
Calculate the net present value of the investment, and decide if the investment is profitable and should be accepted.



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Exercise 3.2

A company is looking into investing in new business activity. If it goes ahead it needs to invest in a machine with a price of 800.000 and a reselling price (residual value) after 6 years of 50.000. The company uses a discount rate of 12% p.a. in evaluating investment decisions.

The expected earnings (cash result before depreciation) for the coming 6 periods (years) can be seen below:

Period	Earnings
1	100.000
2	190.000
3	300.000
4	200.000
5	100.000
6	90.000

Question 1
Calculate the internal rate of return, and decide if the investment is profitable and should be carried out.

Exercise 3.3

A company is looking into investing in new business activity. If it goes ahead it needs to invest in a machine with a price of 800.000 and a reselling price (residual value) after 6 years of 50.000. The company uses a discount rate of 12% p.a. in evaluating investment decisions.

The expected earnings (cash result before depreciation) for the coming 6 periods (years) can be seen below:

Period	Earnings
1	190.000
2	190.000
3	190.000
4	190.000
5	190.000
6	190.000

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Question 1
Calculate the capital service amount and the economic profit. Decide if the investment is profitable and should be carried out.

Exercise 3.4

A company is looking into investing in new business activity. If it goes ahead it needs to invest in a machine with a price of 500.000 and a reselling price (residual value) after 5 years of 10.000.

The expected earnings (result before depreciation) in the coming 5 periods (years) can be seen below:

Period	Earnings
1	80.000
2	200.000
3	230.000
4	100.000
5	70.000

Question 1
Calculate the pay-back period excluding interest.

Exercise 3.5

A company is looking into investing in new business activity. If it goes ahead it needs to invest in a machine with a price of 500.000 and a reselling price (residual value) after 5 years of 10.000. The discount rate is 12% p.a.

The expected earnings (result before depreciation) in the coming 5 periods (years) can be seen below:

Period	Earnings
1	80.000
2	200.000
3	230.000
4	100.000
5	70.000

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Question 1
Calculate the pay-back period including interest.

Exercise 3.6

A company is looking into investing in new business activity. If it goes ahead it will need to invest in a machine with a price of 350.000 and a reselling price (residual value) after 5 years of 40.000. The annual earnings have been estimated to 80.000. The company uses discount rate of 14% p.a. in evaluating investment decisions.

Question 1
Calculate the pay-back period including interest using the "nper" function in Excel.

EXERCISES FOR CHAPTER 4.0

Exercise 4.1

A hostel is considering expanding the capacity from 60 rooms to 80 rooms. For the existing 60 rooms the budget has been prepared for the coming year:

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The expansion of the hostel is expected to amount to 1.500.000. The budget before and after the expansion can be found below:

Budget	Before	After
Sales	1.875.000	2.500.000
Cash capacity costs	1.315.000	1.770.000
Earnings	560.000	730.000

The investment horizon is set at 10 years and the discount rate at 10% p.a. The residual value is expected to be 400.000.

Question 1
Calculate the net present value of the investment, and decide if the investment is profitable and should be carried out.

Exercise 4.2

The local tourist association in a city is considering to investment in a train which can take tourists around the streets of the city. The price of the train is 120.000 while the residual value of the train is expected to be 10.000. The investment horizon is 5 years and the discount rate is 8% p.a.

Income statement budget:

Period	No. of tourists	Price per tourist	Turnover	Capacity costs	Earnings
1	10.000	10,00	100.000	-70.000	30.000
2	11.000	10,00	110.000	-70.000	40.000
3	12.000	10,00	120.000	-70.000	50.000
4	13.000	8,00	104.000	-70.000	34.000
5	11.000	8,00	88.000	-70.000	18.000

Question 1
Calculate the net present value of the investment, and decide if the investment is profitable and should be carried out.

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Exercise 4.3

A company is considering investing in an automatic web based ticket system to substitute personal service. This is expected to save the company salaries of 80.000 per year. The costs savings should thus be used to repay the web based system. However, the operation costs of the system will be about 20.000 per year. The yearly costs saving which are the earnings of the investment is thus (80.000-20.000) = 60.000 per year. We assume that the savings are the same for the entire investment horizon.

The investment horizon is 15 years and there is no expected residual value from the system. The investment in the system is 450.000. The discount rate is set at 10% p.a.

Question 1
Calculate the net present value of the investment, and decide if the investment is profitable and should be carried out.

Question 2
Calculate the internal rate of return of the investment, and decide if the investment is profitable and should be carried out.

Question 3
Calculate the economic profit of the investment, and decide if the investment is profitable and should be carried out.

EXERCISES FOR CHAPTER 5.0

Exercise 5.1

A company is considering investing 800.000 in a machine for a new project. The investment horizon is set to 8 years and the discount rate at 11% p.a. An income statement budget has been prepared as follows:

Income statement budget:

	Units	Price	Total
Sales	39.000	89,00	3.471.000
Cost of goods sold	39.000	-66,00	-2.574.000
Contribution margin			897.000
Cash capacity costs			-770.000
Earnings			127.000

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Question 1
Calculate the net present value of the investment.

Question 2
Calculate the critical value for the number of sales units.

Question 3
Calculate the critical value for the sales price.

Question 4
Calculate the critical value for a residual value.

Question 5
Calculate the critical value for the discount rate (IRR).



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EXERCISES FOR CHAPTER 6.0

Exercise 6.1

A company is looking into investing in one of the two mutually exclusive investment opportunities below. The investment is a rationalization investment, which saves costs in the company. As can be seen the investments and their earnings (cost savings) are very much different. Both investments serve the same purpose and thus only one of them can be selected. The discount rate is 6% p.a. while the investment horizon is set at 8 years for both investments.

The particulars of both investment opportunities can seen below:

Investment opportunity one:

- Initial investment = 1.200.000
- Yearly earnings = 260.000
- Residual value = 50.000

Investment oppertunity two:

- Initial investment = 2.700.000
- Yearly earnings = 550.000

Question 1
Calculate the net present value as well as the IRR for both investments. Decide which investment should be chosen.

Exercise 6.2

A company is looking into investing in one of the two mutually exclusive investment opportunities below. The investment is a rationalization investment which saves costs in the company. As can be seen the investments and their earnings (cost savings) are very much different. Both investments serve the same purpose and thus only one of them can be selected. The discount rate is 9% p.a.

The particulars of both investment opportunities can be seen below:

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Investment opportunity one:

- Initial investment = 1.300.000
- Yearly earnings = 290.000
- Residual value = 150.000
- Investment horizon = 8 years

Investment opportunity two:

- Initial investment = 2.400.000
- Yearly earnings = 550.000
- Investment horizon = 7 years

Question 1
Calculate the net present value as well as economic profit for both investments. Decide which investment should be chosen.

EXERCISES FOR CHAPTER 7.0

Exercise 7.1

A company is considering investing in a new activity within its existing business. The investment itself is a new machine which amounts to 2.000.000. The investment horizon is 5 years after which the residual value is expected to be 350.000. The discount rate is 12% p.a. before tax. The tax rate is 25% while the tax depreciation rate is 25%.

The expected sales and cost of sales can be found below:

Year	Sales	Cost of sales % (of sales)
1	800.000	45%
2	900.000	46%
3	1.100.000	48%
4	750.000	45%
5	700.000	45%

Question 1
Calculate the net present value after tax and decide if the investment should be done.

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Exercise 7.2

A company is considering investing in a new activity within its existing business. The investment itself is a new machine, which amounts to 45.000.000. The investment horizon is 5 years after which the residual value is expected to be 2.000.000. The discount rate is 15% p.a. before tax. The tax rate is 20% while the tax depreciation rate is 20%.

The expected sales and cost of sales can be found below:

Year	Sales units	Sales price	AVC*)	Marketing costs
1	800.000	60	20	15.000.000
2	900.000	65	21	20.000.000
3	1.100.000	70	22	35.000.000
4	750.000	50	24	15.000.000
5	700.000	40	30	0

AVC*) = Average variable costs



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Question 1
Calculate the net present value after tax and decide if the investment should be done.

Question 2
Calculate the net present value before tax.

EXERCISES FOR CHAPTER 8.0

Exercise 8.1

A company is considering investing in a new business activity. The new activity is expected to create the following earnings:

Year	Earnings in fixed prices
1	500.000
2	800.000
3	750.000
4	850.000
5	950.000

The Investment needed is 3.000.000. All figures above are in fixed prices. The real discount rate is set at 12% p.a. (real discount rate is excluding inflation). The inflation rate is set at 3,5% p.a.

Question 1
Calculate the net present value in current prices and decide if the Investment should be made.

Exercise 8.2

A company is considering investing in a new business activity. The new activity is expected to create the following earnings:

Year	Earnings in current prices
1	600.000
2	800.000
3	850.000
4	1.000.000
5	1.200.000

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The Investment needed is 3.000.000. All figures above are in current prices. The nominal discount rate is set at 15% p.a. (real discount rate is excluding inflation). The inflation rate is set at 2% p.a.

Question 1
Calculate the net present value in fixed prices and decide if the Investment should be made.

Exercise 8.3

Company is considering investing in a new business activity. The new activity is expected to create the following earnings:

Year	Earnings in fixed prices
1	200.000
2	200.000
3	400.000
4	500.000
5	600.000

The Investment needed is 1.500.000. All figures above are in fixed prices. The real discount rate is set at 10% p.a. (real discount rate is excluding inflation). The inflation rate is set at 1% p.a.

Question 1
Calculate the net present value in current prices and decide if the Investment should be made.

Question 2
Calculate the net present value in fixed prices and decide if the Investment should be made.

Exercise 8.4

A company is considering investing in a new business activity. The investment in connection with this business activity is 2.300.000.

The investment horizon is expected to be 4 years. There is no residual value in connection with this activity. The investment is expected to generate yearly sales of 1.000.000 which is expected to increase by 5% p.a. throughout the investment horizon.

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The costs on connection with the activity are mainly cost of goods sold (COGS) which are estimated at 300.000 p.a. Cost of goods sold are expected to increase by 1% p.a. throughout the investment horizon. The overall inflation is expected be 2% p.a. throughout the investment horizon. The real interest rate it set at 8% p.a.

The sales and COGS stated above are both in fixed prices.

Question 1
Calculate the net present value in current prices.

EXERCISES FOR CHAPTER 9.0

Exercise 9.1

A company is considering a new investment opportunity.

The investment is 4.500.000. The investment horizon is 4 years and there is no residual value. The yearly sales and cost of goods can be seen in the table below:



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Period	Sales	Cost of goods	Contribution
1	2.000.000	-800.000	1.200.000
2	2.500.000	-1.100.000	1.400.000
3	3.300.000	-1.584.000	1.716.000
4	2.000.000	-820.000	1.180.000

The discount rate is set at 7% p.a.

Customers are given 3 months (90 days) to pay while the company itself has 2 months (60 days) to pay its purchases to its suppliers. The company expects that its inventory days will be 160 days on average.

Question 1
Calculate the net present value of the investment including working capital.

Question 2
Calculate the net present value without working capital.

Exercise 9.2

A company is considering a new investment opportunity.

The investment is 6.000.000. The investment horizon is 4 years and there is no residual value. The yearly sales and cost of goods can be seen in the table below:

Period	Sales units	Sales price	AVC
1	12.000	250	-120
2	14.000	300	-140
3	18.000	340	-180
4	14.000	320	-210

The discount rate is set at 10% p.a.

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Customers are given 2 months (60 days) to pay while the company itself has 1 month (30 days) to pay its purchases to its suppliers. The company expects that its inventory days will be 90 days on average.

Question 1
Calculate the net present value of the investment including working capital.

Question 2
Calculate the critical value for the inventory days.

Question 3
Calculate the IRR based on question 1.

Exercise 9.3

A company is considering a new investment opportunity.

The investment is 6.300.000. The investment horizon is 4 years and there is a residual value of 200.000. The yearly sales and cost of goods-% can be seen in the table below:

Period	Sales units	Sales price	Cost of goods %
1	10.000	200	30%
2	15.000	210	35%
3	25.000	215	40%
4	18.000	180	35%

The discount rate is set at 12% p.a.

30% of the customers are given 1 month (30 days) to pay. The remaining 70% must pay cash.

The company itself has pay its purchases from its suppliers cash.

The company expects that its inventory days will be 50 days on average.

Question 1
Calculate the net present value of the investment including working capital.

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Question 2
Calculate the critical value of the residual value.

EXERCISES FOR CHAPTER 10.0

Exercise 10.1

A bus company is considering investing in a new business activity. The company is considering opening new routes to new destinations. The company knows from previous opening of new routes that in the start the routes will generate increasing sales but when the routes mature and competitors start to move in the sales will drop. Thus the company would like to know if the investment is profitable and when it should leave the investment. To open the new routes, the company will need to invest in a new bus since its existing capacity of busses are fully utilized. A new bus costs 7.000.000. The expected development in the residual value, the maintenance and service cost and contribution are as follows:

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Period	Residual value	Maintenance	Contribution
0	7.000.000		
1	6.000.000	-900.000	4.500.000
2	3.500.000	-1.000.000	4.500.000
3	2.400.000	-2.200.000	4.200.000
4	1.200.000	-2.700.000	4.000.000
5	0	-3.500.000	3.900.000

The discount rate is set at 6% p.a.

Question 1
Calculate the optimal life of the Investment.

Exercise 10.2

A bus company has for many years operated city bus lines for the municipality under a contract. The company has engaged itself in a 10 year contract which it cannot leave during the contract period. The remaining contract period is 8 years. Since the company has already engaged itself in a contract which it cannot leave the sales can be disregarded. The company should instead focus on minimizing the costs relating to operating the contract during the remaining period of 8 years.

The company thus has to consider how to operate at the lowest possible costs. To continue operating the city line the company will need to invest in a new bus since the old bus is worn down existing capacity of busses are fully utilized. A new bus costs 7.000.000. The expected development in the residual value and the maintenance and service costs are as follows:

Period	Residual value	Maintenance
0	7.000.000	
1	5.000.000	-900.000
2	3.200.000	-1.000.000
3	2.400.000	-2.200.000
4	1.200.000	-2.700.000
5	0	-3.500.000

The discount rate is set at 6% p.a.

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Question 1
Calculate the optimal life of the investment under the assumption of identical replacement.

Exercise 10.3

A bus company has for many years operated city bus lines for the municipality under a contract. The company has engaged itself in a 10 year contract which it cannot leave during the contract period. The remaining contract period is 8 years. Since the company has already engaged itself in a contract which it cannot leave the sales can be disregarded. The company should instead focus on minimizing the costs relating to operating the contract during the remaining period of 8 years.

The company thus has to consider how to operate at the lowest possible costs.

The bus company already owns a bus. The expected development in the residual value, the maintenance and service cost for the current bus are in accordance with exercise 10.1. Please disregard the contribution.

The company just received an offer for a new bus. The expected development in the residual value and the maintenance and service costs for the offered bus are in accordance with exercise 10.2.

Question 1
When should the company replace the old bus with the new bus?

GENERAL EXERCISES IN INVESTMENT

Exercise 1

A planned investment of 2.400.000 in a new hotel building is expected to increase the earnings of the hotel by 750.000 per year for 5 years. After 5 years the residual value is 0. The discount rate is set at 12% p.a.

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method,
- Annuity method.

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Exercise 2

A company is considering investing in a tourist attraction expected to make earnings of 850.000 per year for 8 years. The investment is 3.800.000 and residual value after 8 years estimated at 800.000. The discount rate is set at 16% p.a.

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method,
- Annuity method.

Exercise 3

A company is considering investing 250.000 in a rationalization project. The investment is a new machine which will lead to cost savings in salaries since staff can be cut back. The investment horizon is 4 years and a residual value after 4 years expected to be 125.000. The discount rate is 15% p.a.



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The cost savings (earnings) from the investment expected to be 48.000, 64.000, 76.000 and 84.000 respectively.

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method.

Exercise 4

Two graduates are considering setting up a new business together. For this they need to invest 1.450.000 in premises, furniture etc.

They expect an investment horizon of 5 years. An alternative to setting up this business is for each of them to apply for a job which will give them each a yearly salary of 180.000. The discount rate is set at 20% p.a. No residual value is expected.

Various researches have now resulted in the preparation of the following marketing plan. The researches had a cost of 300.000. Find below expected contribution and sales promotion costs:

Period	Contribution	Sales promotion
1	600.000	-300.000
2	1.000.000	-250.000
3	1.400.000	-200.000
4	1.700.000	-150.000
5	2.000.000	-100.000

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method.

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Question 2
Calculate the following critical values:

- Critical value for the salaries,
- Critical value for sales promotion in period 5.

Exercise 5

A caravan site is considering investing in an outdoor swimming pool for their customers. The investment amounts to 300.000 and the residual value is expected to be 50.000 in dismantling costs. The caravan sit is using a discount rate of 8% p.a. The investment horizon is 4 years.

If the caravan site chooses to invest in the outdoor swimming pool it is expecting more visitors. The caravan site has calculated the marginal increase in annual contribution to from the increase in visitors to 100.000, 108.000, 115.000 and 118.000 respectively. There are no extra cash capacity costs.

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method.

Question 2
Calculate the following critical values:

- Critical value for dismantling costs,
- Critical value for the discount rate (IRR).

Exercise 6

A company is considering investing in new surfaces on its production floor. The purpose of this investment is to save cleaning costs. The cost of replacing the existing floor in the production and of a cleaning machine to keep the place clean is 2.500.000.

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The new surfaces can save salary costs of cleaning as follows:

Period	Salaries saved
1	600.000
2	648.000
3	700.000
4	756.000
5	816.000

The residual value after the 5 years is estimated at 200.000 in disposal costs. By that time the entire floor has to be replaced and a new cleaning machine purchased. Discount rate is set at 16% p.a. and the investment horizon is 5 years.



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Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method.

Question 2
Calculate the following critical values:

- Critical value for disposal costs,
- Critical value for saved salaries in period 3.

The company now learns that if it does not go ahead with the investment in new floor in the production area it will have to renovate the current floors. This renovation will cost 500.000. The renovation costs can of course be disregarded if the company chooses to go ahead with the investment in new floors.

Question 3
Explain if the information given above on the renovation should be included in the investment evaluation. If the answer to this is positive, prepare a new investment evaluation using the following methods:

- Net present value method,
- Internal rate of return method.

Exercise 7

A company is considering expanding its production capacity (in existing buildings) by investing in a new machine with a value of 1.400.000. The machine is expected to have a positive residual value of 450.000 at the end of the investment horizon of 5 years. The purpose of this investment it to expand the existing business by taking market shares from the competitors. Find below the expected marginal changes caused by taking a larger market share from competitors. Find below the expected marketing margin and cash capacity costs:

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Period	Marketing margin	Cash capacity costs
1	700.000	-360.000
2	800.000	-378.000
3	900.000	-397.000
4	900.000	-416.000
5	900.000	-438.000

Discount rate is set at 20% p.a.

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method.

Question 2
Calculate the following critical values:

- Critical value for residual value,
- Critical value for capacity costs in period 4.

The company now learns that if it does not go ahead with the investment in new machinery and the expansion the unused space in its existing building can be rented out to another company. The yearly rent is estimated to be 70.000.

Question 3
Explain if the information given above on the sub rent of space to another company should be included in the investment evaluation. If the answer to this is positive prepare a new investment evaluation using the following methods:

- Net present value method,
- Internal rate of return method.

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Exercise 8

A company is considering investing in a new activity. The purchase price is 1.100.000 to which should be added installation costs of 200.000. The investment horizon is 5 years. The investment has no expected residual value. Maintenance and other cash capacity costs are estimated to 300.000 per year. The company expects the contribution margin for this new activity to be 350.000, 800.000, 950.000, 1.050.000 and 1.100.000 respectively. Discount rate is set at 18% p.a.

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method.

Exercise 9

A museum is considering opening restaurant in connection with its exhibition to service the tourists. Total investment for establishing and furnishing the restaurant is 2.160.000. The investment horizon is 5 years, and the residual value is expected be 0. Further cash capacity costs are expected to be 300.000 per year.



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The museum has worked out the assumptions below concerning the activity in the restaurant:

Period	Sales price	Variable cost per unit	Sold units
1	95,00	-70,00	30.000
2	105,00	-75,00	40.000
3	110,00	-77,00	50.000
4	110,00	-80,00	55.000
5	100,00	-81,00	50.000

The discount rate is set at 20% p.a.

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method.

Exercise 10

An amusement park is considering establishing a new activity in one of its amusement park, where groups of employees from firms and groups of pensioners can visit the amusement park outside the peak season. Groups can be of up to 400 persons per day. These visitors are to pay an admission fee plus "catering". The following prices will cover the whole of their visit to the amusement park outside the season.

- 150 per person incl. meal and soft drinks – gross margin is 50%
- 75 per person incl. cake and coffee – gross margin is 75%

The number of visitors expected to visit the park outside the season is:

- 18 days with meal incl. soft drink for 340 persons
- 63 days with cake and coffee for 50 persons

The extra costs of the off season opening are expected to be:

- Wages for 9 hours per day. Hourly pay is 200
- Other cash capacity costs are estimated to 10.000

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Outside the peak season the summer activities, gardens and surroundings are maintained and repaired. This costs 300.000 on a yearly basis and will still be carried out during the new off season activity.

The investment horizon is 3 years. The investment is 1.500.000 and they expect the residual value to be 100.000. The discount rate is set at 15% p.a.

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method,
- Annuity method.

Question 2
How much can the amusement park maximum invest? (Calculate the critical value of the initial investment).

Exercise 11

The airline company Summerflight Inc. fly tourists from 3 cities. For the coming 3 years the sales and airport taxes have be estimated according to below:

City	Sales	Airport tax
NY	168.000	6.000
WDC	156.000	6.000
SF	148.000	4.000

In each city arrangements have been made with an assistant who gets a commission of 15% of the sales for taking care of booking. The airline leases 3 aircrafts at the time being. The leasing arrangement runs for another 3 years at 80.000 per aircraft per year. The administrative costs for the 3 coming years are estimated at 25.000 per year.

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Summerflight is considering opening a route to a new city. The opening of the route is estimated to earning 164.000 in yearly sales and cost 6.000 in yearly airport taxes per year for 3 years. The current rented aircrafts do not have the capacity to take on the extra route. Thus the company will have to financial lease another aircraft for this route. This investment is 350.000 – there is not residual value. The discount rate is set at 14% p.a. As with the current routes a 15% commission is also expected. The administrative costs are expected to increase from 25.000 per year to 35.000 per year because of the extra route. The investment horizon is 3 years.

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method,
- Annuity method.

Question 2
What should the yearly sales be for the investment to be profitable? (Calculate the critical value of the yearly sales).



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Exercise 12

An amusement park is considering establishing a new activity in its park. The activity is an adventure simulator. This simulator holds up to 50 people at the time. Through several movies the guests can experience different situations and adventures (fly crash, car chase and so on) as if they were taking part of it themselves.

All activities in the park are pay-as-you-go. This means that all activities have to be paid separately. No admission fee is paid at the entrance.

The investment in the simulator is 2.000.000 and is expected to have a residual value of 200.000 after 10 years of use.

The yearly maintenance costs are 50.000 concerning the new activity. The wages are expected to increase from 150.000 to 250.000 also because of the new activity.

In all the years the amusement park expects an occupancy rate per show is 60% and they expect to have 6 shows per day in 150 days (the total summer season).

The investment horizon is 10 years and the discount rate is set at 10% p.a.

Question 1
How much would each guest have to pay for the activity to be profitable? (Calculate the critical value of the ticket price).

Exercise 13

A bus company is considering investing in two new busses. The total investment in these two busses is 10.000.000. The investment horizon is 10 years after which the expected residual value is 6.000.000 in total for both busses.

The two busses will run for 360 days a year. The company will have to hire additional bus drivers for the two new busses. This together with service, maintenance, repairs, gas and so on will cost 2.500.000 per year. The discount rate is set at 9% p.a.

Assume that 18.000 tickets are sold on a yearly basis.

Question 1
How much would each guest have to pay for a bus ticket for the investment to be profitable? (Calculate the critical value of the ticket price).

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Exercise 14

A hotel chain is considering introduce The Green Key concept. Under this concept the hotel will make extra efforts to protect the environment. If the hotel chain chooses to introduce the concept the following investments have to be made:

- All electrical bulbs have to be replaced by new LED bulbs. This is estimated to cost 200.000.
- Renovation of bath rooms with new water saving toilets will amount to 300.000.
- Changes in the kitchen will amount to 250.000.
- Other changes and investments will amount to 147.000.

If the hotel chain chooses to go ahead with the investment it can avoid annual maintenance of 50.000 in the old bath rooms.

The management of the hotel chain is expecting the introduction to result in both cost saving and extra customers. The following changes are expected:

- Yearly energy savings of 180.000.
- Extra customers generating extra sales of 300.000 on a yearly basis (expected gross margin is 45%).
- Extra cash capacity costs of 60.000.

The investment horizon is set at 5 years for which the above assumptions apply. There is no residual value. Discount rate is set at 15% p.a.

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method.

Exercise 15

A company is considering establishing a mini golf area, and the following information has been collected:

- The total investment is expected to be 1.300.000.
- To finance the investment the company can obtain a 10 year loan at 8% p.a., so it decides to use a discount rate, which is 50% higher than the loan rate.

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- The investment horizon is 10 years, and the residual value is expected to be 200.000.
- The "green" fee will be 50 for adults and 30 for children per day.
- The company expects to sell week passes and the price of those is expected to be 200 for adults and 120 for children.

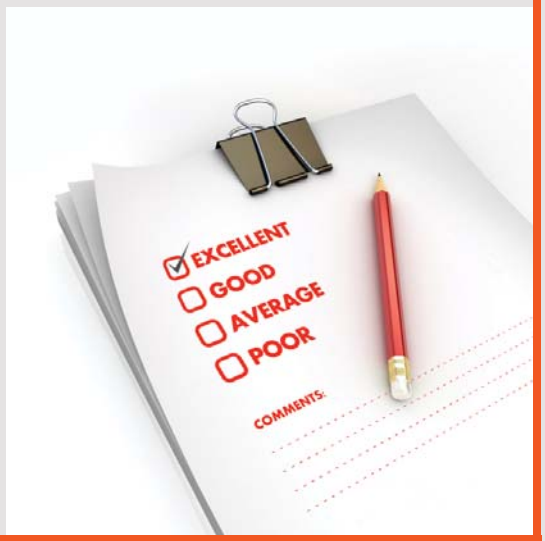
The estimated number of guests for the next 10 years is estimated to be:

	No of guests for the first 5 years per year	No of guests for the last 5 years per year
Adults – one day passes	3.000	5.000
Children – one day passes	4.000	6.000
Adults – week passes	400	500
Children – week passes	500	1.000

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The yearly cash capacity costs for maintenance and operation is expected to be 150.000 for the first 5 years and 160.000 for the last 5 years. An alternative to investing in the mini golf area is to sublet the premises to another company which would like to start a mini golf area as well. The annual rent income from the sublet is expected to be 130.000 per year for the entire 10 year period.

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method.

Exercise 16

A company is considering starting an airline operation and has gathered the following information:

- Total investment 50.000.000.
- Cash capacity costs per year 8.650.000.
- Contribution margin % is expected to be 60%.
- Investment horizon is 20 years and the residual value is 15.000.000.
- It is expected capacity costs and contribution margin % remains unchanged in all 20 years.
- Discount rate is set at 9% p.a.

Question 1
Calculate the size of the sales which will make the investment just profitable (critical value of the sales).

If it turns out that the yearly sales are expected to be 30.000.000.

Question 2
Calculate the critical values of the investment.

Exercise 17

A company has prepared the following budgets for the income statement for a new activity for the coming 5 years:

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Income statement budget:

	1	2	3	4	5
Sales	80.000.000	90.000.000	105.000.000	120.000.000	140.000.000
Cost of goods sold	-8.000.000	-9.000.000	-11.000.000	-12.000.000	-14.000.000
Contribution	72.000.000	81.000.000	94.000.000	108.000.000	126.000.000
Cash capacity costs	-50.000.000	-55.000.000	-60.000.000	-70.000.000	-80.000.000
Result before depreciations	22.000.000	26.000.000	34.000.000	38.000.000	46.000.000
Depreciations	-16.000.000	-18.000.000	-22.000.000	-24.000.000	-28.000.000
Result before interest	6.000.000	8.000.000	12.000.000	14.000.000	18.000.000
Interest	-4.000.000	-6.000.000	-7.000.000	-8.000.000	-10.000.000
Result	2.000.000	2.000.000	5.000.000	6.000.000	8.000.000

The total investment is 150.000.000. However the payment of the investment is spread over three years as follows:

Year	Investment
0	-100.000.000
1	0
2	0
3	-40.000.000
4	-10.000.000
5	0

The discount rate is set at 10% p.a., and the residual value in year 5 is expected to be 42.000.000. The investment horizon is 5 years.

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Question 1
Calculate the profitability of the project using the following method:

- Net present value method.

Exercise 18

A company wants to establish a new activity within its existing operations. The investment is expected to be 3.000.000. The cash capacity costs are expected to be 2.000.000 per year and the expected contribution margin % is 70%. The investment horizon is 10 years, and residual value is 1.000.000. Discount rate is set at 15% p.a.

Question 1
Calculate the minimum sales which will make the investment just profitable (critical value of the sales).

It turns up that the expected yearly sales are expected to be 5.000.000.

Question 2
Calculate the critical values of the investment.



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Exercise 19

MediCorp is a company operating in the medical sector. The company is developing all its products by itself. Currently the company is developing a new anticoagulant product which can improve the survival chances after a cardiac clot.

The development of the new product was originally budgeted to cost 120.000.000. 30.000.000 of this amount has already been paid. Latest forecast of the development cost does however show that budget will be exceeded by 15%.

For the production of the new medical product the company needs to invest in a new machine. The new machine can be setup in a vacant area in an existing factory building. The machine costs 10.000.000. Due to heavy snow on the roof above the area in which the machine can be setup the roof collapsed. It is estimated that a new roof will cost 2.000.000 of which 25% is covered by the company's building insurance. Prior to setting up the machine in the vacant area the roof must of course be replaced by a new one.

The new medical product has budgeted contributions as follows:

Year	Contribution
1	45.000.000
2	45.000.000
3	45.000.000
4	15.000.000
5	15.000.000

The investment a horizon of 5 years. The discount rate is set at 12% p.a.

Question 1
Calculate the profitability of the project using the following methods:

- Net present value method,
- Internal rate of return method.

and decide if the project should be finalized.

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Exercise 20

A company is considering investing in a new project. If it goes ahead with the project it needs to invest in a new machine. The investment in the machine is 600.000. The machine has a life of 6 years and it has no residual value at the end of its life. Contributions in connection with the investment can be found below:

Year	Contribution
1	150.000
2	220.000
3	250.000
4	100.000
5	50.000
6	90.000

The interest rate is set at 9% p.a. The investment horizon is 6 years.

Question 1
Calculate the payback period both excluding interest and including interest.

Exercise 21

A company is considering investing in a new project. If it goes ahead with the project it needs to invest in a new machine. The machine costs 600.000 and has no residual value. The project will earn the company a yearly contribution of 150.000 for 10 years. The interest rate is set at 9% p.a. The investment horizon is 10 years.

Question 1
Calculate the payback period.

Exercise 22

3. Real discount rate = 10%; Inflation = 3%
4. Nominal discount rate = 5%; Inflation = 2%
5. Real discount rate = 6%; Inflation = 5%
6. Nominal discount rate = 7%; Inflation = 4%

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Question 1
Convert the above interest rates into nominal interest rate and real interest rates respectively.

Exercise 23

Question 1
Convert the following amounts to fixed and current prices respectively:

Year	Current prices	Fixed prices – infl. 3% p.a.	Fixed prices	Current prices – infl. 5% p.a.
0	-1.000.000		-800.000	
1	120.000		150.000	
2	150.000		120.000	
3	180.000		180.000	

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Year	Current prices	Fixed prices – infl. 4% p.a.	Fixed prices	Current prices – infl. 2% p.a.
0	-600.000		-700.000	
1	100.000		190.000	
2	120.000		90.000	
3	130.000		150.000	

Exercise 24

A company is considering investing in a new project. If it goes ahead with the project it needs to invest in a new machine. The machine costs 600.000 and is expected to have a residual value of 100.000 at the end of its life (4 years). The investment is expected to earn the company the following contributions:

Year	Contribution
1	165.000
2	170.000
3	180.000
4	210.000

The amounts mentioned above are all in current prices (thus including inflation) (also the residual value). The nominal discount rate is 9% p.a. The inflation is expected to be 3% p.a.

Question 1
Calculate:

- The net present value in current price,
- The net present value in fixed prices.

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Exercise 25

The company Goodison Road A/S sells, manufactures and develops football gear. The company has been working on the development of a new type of football for an extended period of time. What is special about the football is that it is extremely hard-wearing and therefore very well suited for asphalt, cement and similar surfaces. The football is not expected to compete with the company's current range of footballs, which are suited for gravel and lawn surfaces.

The development project has been going on for about two years and has cost the company 600.000 in development of materials, experimental production and testing of prototype. The company has now progressed with the development to the point where it has a fully developed football ready for immediate production. However, the company does not have the necessary production equipment, which it needs to purchase to commence production. The production equipment will cost 3.000.000 and is expected to have no value at the end of the investment horizon. The investment horizon is four years. In connection with the launch of the new type of football, the company has estimated the following figures:

Year	Sales	Cost of sales	Other costs
1	3.500.000	-1.575.000	-900.000
2	4.000.000	-1.800.000	-1.275.000
3	4.300.000	-1.935.000	-1.100.000
4	4.700.000	-2.115.000	-1.356.000

The company uses a rate of interest for calculation purposes (discount rate) of 11% p.a.

Question 1
Calculate the net present value and internal rate of return for the development project based on information relevant for the decision. You should also decide whether the development project is profitable.

The company now discovers that it has calculated the figures above in fixed prices. The company knows that the cost of the materials used in the production depends on the development in the price of oil. The company also assumes that any increases in the cost of goods sold can only be passed on to the sales price of the finished footballs to a very limited extent.

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The company expects that the cost of goods sold will increase by 8% per year with effect from year 1. The company expects that sales prices can only be increased by 1.5% per year with effect from year 1. The other costs are not expected to increase. The company uses a nominal discount rate for calculation purposes 13% p.a.

Question 2
Calculate the net present value of the development project in current prices.

Exercise 26

Discount rate before tax = 8%
Discount rate after tax = 7%
Discount before tax = 6%
Discount rate after tax = 8%

Question 1
Convert the above interest rates into before and after tax respectively.



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Exercise 27

A company is considering investing in a new project. If the company chooses to go ahead with the project it will need to buy a new machine. The machine costs 800.000 and is expected to have a residual value of 50.000 at the end of its life. The investment horizon is 6 years. The investment is expected to earn the company the following contributions:

Year	Contribution
1	120.000
2	150.000
3	140.000
4	150.000
5	200.000
6	180.000

The discount rate is set at 10% p.a. before tax. Assume a tax rate of 20% and a tax depreciation rate of 20%.

Question 1
Calculate the net present value after tax.

Exercise 28

A company is considering investing in a new project. If the company chooses to go ahead with the project it will need to buy a new machine. The machine costs 4.000.000. It is estimated that the residual value is 150.000 at the end of its life. The investment horizon is 5 years.

The company has made a budget for the investment. The budgeted sales and cost of sales can be seen below:

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Year	Sales	Cost of sales
1	2.000.000	-1.000.000
2	2.500.000	-1.250.000
3	2.800.000	-1.400.000
4	2.500.000	-1.250.000
5	1.800.000	-900.000

All purchases from creditors are paid cash. Trade receivable turnover rate is expected to be 4 times a year while the stock turnover rate is expected to be 3 times a year. The discount rate is set at 10% p.a.

Question 1
Calculate the net present value including net working capital.

Question 2
Calculate the critical value for trade receivable turnover rate.

Question 3
Calculate the net present value excluding net working capital.

Exercise 29

A sole trader is considering opening a new shop where he wants to sell paint to both households and companies. If he chooses to go ahead he will need to buy furniture for the shop (shelves, lamps, desks). This is estimated to cost 3.250.000 and is no estimated to have any value after 4 years. The sole trader is also transferring furniture from a shop he just closed. The historical cost price for this was 1.000.000. The furniture from the closed shop cannot be sold.

The trader also needs to rent a shop. The rent for the shop is 1.000.000 per year. Furthermore the trader needs to pay a deposit of 250.000. The deposit is not recovered once the shop is closed again.

The trader has made a budget for the investment. The budgeted sales and cost of sales % can be seen below:

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Year	Sales	Cost of sales-%
1	2.500.000	30%
2	6.000.000	35%
3	4.000.000	40%
4	3.000.000	50%

It is estimated that 60% of the revenue is sold to companies while the remaining 40% is sold to households. Companies are given 2 months of credit (trade receivable turnover rate is 6 times per year) while households have to pay cash.

The stock turnover rate is 3 times per year. Purchases are made on 2 months of credit from the creditors (creditors turnover rate is 6 times a year). The discount rate is 20% p.a. The investment horizon is 4 years.

Question 1
Calculate the net present value including net working capital.



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Question 2
Calculate the net present value including net working capital if the if the creditor's turnover rate is changed from 6 to 8 times a year.

Question 3
Calculate the net present value excluding net working capital.

Exercise 30

A company is considering investing in a new machine. Please find the economic details about the machine below:

Year	Residual value	Maintenance	Investment
0	5.000.000	0	5.000.000
1	4.500.000	-800.000	0
2	3.800.000	-900.000	0
3	2.700.000	-1.000.000	0
4	1.200.000	-1.400.000	0
5	0	-2.000.000	0

The yearly contribution is estimated to be 2.300.000 for all 5 years. The discount rate is set at 5% p.a.

Question 1
Calculate the optimal life of the machine under the no replacement scenario.

Exercise 31

A taxi company is considering investing in two new taxis. Please find the economic details both the taxis below:

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Year	Residual value	Maintenance	Investment
0	2.000.000	0	2.000.000
1	1.900.000	-200.000	0
2	1.800.000	-200.000	0
3	1.700.000	-200.000	0
4	1.400.000	-400.000	0
5	900.000	-500.000	0

The discount rate is 5% p.a.

Question 1
Calculate the optimal life of the two taxis under the identical replacement scenario.

Exercise 32

A company is considering investing in a cost saving project. If it goes ahead with the project it needs to invest in a new machine. The machine costs 1.200.000. The company has already paid 200.000 of this initial amount. This payment is not refundable if the project is terminated. The machine has a life of 5 years and a negative residual value of 100.000.

The company has calculated its production costs before and after the investment. The amounts can be found in the table below:

Year	Before	After
1	390.000	190.000
2	470.000	220.000
3	470.000	220.000
4	585.000	300.000
5	390.000	190.000

The company has also paid 50.000 in preliminary investigations. The discount rate is set at 6% p.a. The investment horizon is 5 years.

Question 1
Calculate the net present value of the cost saving project.

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EXERCISES FOR CHAPTER 14.0

Exercise 14.1

Consider a standing loan with a nominal value of 3.000.000. The nominal interest rate is 5% p.a. The loan is repaid over a period of 4 years in quarterly payments.

Question 1
Prepare an amortization table of the loan.

Exercise 14.2

Consider a serial loan with a nominal value of 4.000.000. The nominal interest rate is 4% p.a. The loan is repaid over a period of 3 years in semi-annual payments.

Question 1
Prepare an amortization table of the loan.

Exercise 14.3

Consider an annuity loan with a nominal value of 5.000.000. The nominal interest rate is 6% p.a. The loan is repaid over a period of 2 years in monthly payments.

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Question 1
Prepare an amortization table of the loan.

EXERCISES FOR CHAPTER 15.0

Exercise 15.1

Company is looking to take up a new loan. The new loan has the following assumptions:

Nominal value = 1.800.000
Bond rate = 98
Commission costs = 54.000
Nominal interest rate = 8% p.a.
Repayment period = 2 years
Payments per year = 2

Question 1
Calculate the proceeds from the loan.

Question 2
Calculate the effective interest rate p.a. assuming that the loan is a standing loan (bullet loan).

Question 3
Calculate the effective interest rate pa assuming that the loan is a serial loan.

Question 4
Calculate the effective interest rate p.a. assuming that the loan is an annuity loan.

Exercise 15.2

A Company is looking to take up a loan. The Company needs proceeds of 2.000.000.

The loan has the following assumptions:

- Commission costs = 2% of market value
- Bond rate = 96
- Annuity loan
- 3 year loan with 4 payments per year
- Nominal interest rate p.a. = 6% p.a.

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Question 1
Calculate the nominal value of the loan.

Question 2
Calculate the effective interest rate of the loan.

Exercise 15.3

A company is considering an investment project. The investment project is about to be launched shortly.

The total amount of the investment project is 18.000.000.

The company can finance some of the investment by selling one of its production buildings, which is no longer in used.

According to the assessment made by a property agent, the production building can be sold at a price of 12.000.000 cash. The building is mortgaged with a loan of 5.200.000, which has to be repaid when the building is sold.

To cover the rest of the investment the company has made contact with its bank. The bank will only finance the part of the investment which company cannot cover with the proceeds*) from the sale of the building.

The remaining financing will be done as a bank loan payable in equal semiannual payments over a 7-year period. The nominal rate of interest is set at 5% per year. The bank charges 330.000 in borrowing costs in connection with the payment of the loan. These borrowing costs are included in the borrowed sum.

*) Proceeds = price paid for building – debt repayable on the sale of the building

Question 1
Calculate the proceeds and the nominal value that the company needs to borrow from its bank when the bank's conditions must are met.

Question 2
Prepare a payment schedule (amortization/settlement schedule/plan) for the full loan period.

Question 3
Calculate the effective annual interest on the bank loan with 2 decimals.

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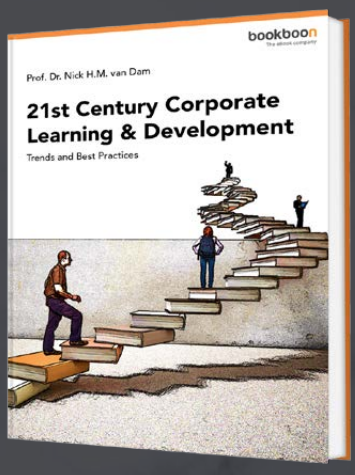
Exercise 1

A company has the following overdraft account with its bank:

- Overdraft maximum is 1.500.000.
- Interest on overdraft is 12% p.a. + 1/2% commission of maximum per quarter. Interest is also calculated on a quarterly basis.

Question 1
Calculate the effective interest rate on the overdraft account assuming that the overdraft is always fully utilized.

Question 2
Calculate the effective interest rate on the overdraft account assuming an average overdraft of 1.200.000.

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Exercise 2

A company is offered the following payment terms by its supplier:

- Payment: 8 days less 3% or
- Payment: 3 months net

The company pays an effective interest rate of 15% p.a. on its overdraft account.

Question 1
What term of payment should the company choose?

Exercise 3

A company is offered the following payment terms by its supplier:

- Payment 40 days less 2% or
- Payment 90 days net

The company pays an effective interest rate of 13,5% p.a. on its overdraft account.

Question 1
What term of payment should the company choose?

Exercise 4

A company has an overdraft account with an agreed maximum of 700.000.

The company draws an average of 500.000 on this overdraft account. The nominal interest rate on the overdraft account is 14% p.a. + 1,5% commission per quarter of the agreed maximum. Interest is also calculated on a quarterly basis.

Question 1
Calculate the effective interest rate on the overdraft account.

One of the company's suppliers offers the company the choice between the following payment terms:

- 3 months net or
- 45 days less 2% or
- 8 days less 3%

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Question 2
What term of payment should the company choose? We assume that unutilized maximum of 200.000 (700.000 – 500.000) can be used at any time to pay the supplier.

Exercise 5

A company is offered a 4-year annuity loan with a nominal value of 235.000 with a nominal rate of interest of 10% p.a. and with annual payments. The proceeds from the loan are 220.000.

Question 1
Prepare an amortization plan loan and calculate the effective interest rate for the offered loan.

Exercise 6

A company is offered an annuity loan with a nominal value of 520.000. The loan is to be repaid in 6 annual payments. The nominal interest rate is 8% p.a. The proceeds from the loan are 500.000.

Question 1
Prepare an amortization plan and calculate the effective interest rate for the offered loan.

Exercise 7

A company is offered a serial loan with a nominal value of 980.000. The loan is to be settled over 4 years with annual payments. The nominal interest rate is 10% p.a. The proceeds from the loan are 960.000.

Question 1
Prepare an amortization plan and calculate the effective interest rate for the offered loan.

Exercise 8

A company is offered a standing loan (bullet loan) with a nominal value of 900.000 over 5 years at a rate of 8% p.a. The loan is settled in annual payments. The proceeds from the loan are 860.000.

Question 1
Prepare an amortization plan and calculate the effective interest rate for the offered loan.

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Exercise 9

A company is offered an 8-year annuity bond loan with semi-annual payments. The nominal value of the loan is 2.000.000 and the nominal interest rate is 10% p.a. The bond rate is 85. Commission costs are 60.000.

Question 1
Prepare an amortization plan and calculate the effective interest rate for the offered loan.

Exercise 10

A company is offered a 10-year serial bond loan with semi-annual payments and a nominal interest rate of 12% p.a. The loan has a nominal value of 3.000.000. The bond rate is 95. Commission costs are 120.000.

Question 1
Prepare an amortization plan and calculate the effective interest rate for the offered loan.

Question 2
Prepare an amortization plan and calculate the effective interest rate for the offered loan if the payments are changed to quarterly payments.



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Exercise 11

A company is offered a 5-year serial bond loan with semi-annual payments. The nominal interest rate is 5% p.a. and the nominal loan value is 4.000.000. The bond rate is 98. Commission costs are 215.000.

Question 1
Prepare an amortization plan loan and calculate the effective interest rate for the offered loan.

Exercise 12

A company has received the following financing offers from its bank:

Serial bond loan:

- Nominal value of 720.000
- The bond rate is 99,5
- Commission costs of 15.000
- The settling period is 4 years
- Nominal interest rate of 10% p.a.
- Annual payments

Standing bond loan (bullet loan):

- Nominal value of 750.000
- The bond rate is 93
- Commission of 1% of the nominal value
- The settling period is 3 years
- Nominal interest rate of 8% p.a.
- Semi annual payments

Annuity bond loan:

- Nominal value of 730.000
- Bond rate is 96.5
- Commission of 0,5% of the nominal value + 6.000
- The settling period is 2 years
- Nominal interest rate of 9% p.a.
- Quarterly payments

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Question 1
Prepare an amortization plan loan and calculate the effective interest rate for the offered loans.

Exercise 13

A company is offered a loan with proceeds of 2.000.000. The loan is a serial loan, and the repayment time is 5 years. The nominal interest rate is 8% p.a., and the loan is settled in semi- annual payments. Commission of 1,5% of the nominal value + 20.000 is charged.

Question 1
Prepare an amortization plan loan and calculate the effective interest rate for the offered loan.

Exercise 14

An investor is forming a new company. The company is formed with the purpose of making an investment of 4.000.000. The investor is transferring 1.000.000 of his private capital to the company giving him shares in return. The remaining 3.000.000 will have to be raised as a loan.

The company has two financing offers to choose between:

1. A standing bond loan (bullet loan) with a repayment time of 10 years. There are semi-annual payments and the nominal interest rate is 4% p.a. The bond rate is 95. Commission of 10% of the market value + 100.000 is charged.
2. A serial bond loan with a repayment time of 10 years. There are semi-annual payments and the nominal interest rate is 8% p.a. The bond rate is 90. Commission 35.000 is charged.

Question 1
Prepare an amortization plan loan and calculate the effective interest rate for the offered loans. Please note that the proceeds of the two loans must equal 3.000.000 to satisfy the company's capital requirements.

Exercise 15

A company is considering the following bond loan:

- Proceeds of 400.000
- Bond rate is 91
- Nominal interest 6% p.a.
- Semi-annual payments

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- Initial costs 6.000
- Annuity loan
- The loan runs for 2 years

Question 1
Prepare an amortization plan loan and calculate the effective interest rate for the offered loan.

Exercise 16

A company is considering 2 offers for a loan with proceeds of 1.000.000:

Serial loan:

- Initial costs 100.000
- Nominal interest rate is 6% p.a.
- Repayment period is 10 years with annual payments



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Standing loan:

- Initial costs 150.000
- Nominal interest rate is 5,5% p.a.
- Repayment period is 10 years with annual payments

The company wants to have proceeds of 1.000.000.

Question 1
Prepare an amortization plan loan and calculate the effective interest rate for the offered loans. Please note that the proceeds of the two loans must equal 1.000.000 to satisfy the company's capital requirements.

Exercise 17

A Danish company is offered a loan in foreign currency with a nominal value of 1.000.000 CHF. The loan is a serial loan, and the repayment period is 5 years with annual settlements. Commission of 1,0% of the nominal value + 1.000 is charged. Both the fixed and the variable commission are charged in CHF. The loan will be settled in CHF using DKK.

The company is expecting a 0,5% p.a. weakening of DKK against CHF during the repayment period.

The nominal interest rate is 0,76% p.a. and the spot exchange rate is 4,89365 DKK/CHF. The exchange rate of 4,89365 means that 1 CHF can be converted to 4,89365 DKK.

Question 1
Prepare an amortization plan loan and calculate the effective interest rate for the offered loan.

Exercise 18

A Norwegian company is offered a loan in foreign currency with a nominal value of 4.000.000 SEK. The loan is a serial loan, and the repayment period is 2 years with semi-annual settlements. Commission of 25.000 SEK is charged. The loan will be settled in SEK using NOK.

The company is expecting a 1,5% p.a. strengthening of SEK against NOK during the repayment period.

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The nominal interest rate is 3,00% p.a. and the spot exchange rate is 0,7 SEK/NOK. The exchange rate of 0,7 means that 1 SEK can be converted to 0,7 NOK.

Question 1
Prepare an amortization plan loan and calculate the effective interest rate for the offered loan.

Exercise 19

A company has received the following financing offer from its bank:

Annuity loan

The loan has semi-annual settlements during its repayment period of 4 years. The nominal interest rate is 10% p.a. The nominal value of the loan is 100.000.

Question 1
Calculate the net present value of the offered loans using a discount rate of 8% p.a.

Exercise 20

A company has received the following financing offers from its bank:

Annuity loan
The loan has quarterly settlements during its repayment period of 6 years. The nominal interest rate is 6% p.a. The commission costs are 350.000. The nominal value of the loan is 6.350.000 so that the proceeds amount at 6.000.000.

Serial loan
The loan has semi-annual settlements during its repayment period of 4 years. The nominal interest rate is 7% p.a. The commission costs are 2% of the nominal value. The proceeds of the loan must amount at 6.000.000.

Question 1
Calculate the effective interest rate for the offered loans.

Question 2
Calculate the net present value of the offered loans using a discount rate of 8% p.a.

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Exercise 21

A company is considering investing in a new machine. The company can choose to either purchase or lease the machine.

Concerning purchase of the machine:

The machine has a cost of 1.000.000 and is expected to have a residual value of 30.000 after 5 years of use.

The machine has a life of 5 years.

Concerning lease of the machine:

If it is decided to lease the machine the lease details are as follows:

- Leasing period = 5 years
- Leasing payment = 223.958 (prepaid)
- There is no residual value because the company does not own the machine.

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General assumptions:
The company is expecting the following contributions from the investment:

Year	Contribution
1	400.000
2	300.000
3	250.000
4	150.000
5	100.000

Discount rate is 7% nominal p.a.

Question 1
Calculate the net present value of the investment if the company choose to purchase and lease (taking the contribution into account).

Question 2
Calculate the net present value of the investment if the company choose to purchase and lease (not taking the contribution into account).

Question 3
Calculate the net present value after tax of the investment if the company choose to lease the machine (taking the contribution into account). Use a tax rate of 20%.

Question 4
Calculate the net present value after tax of the investment if the company choose to lease the machine (not taking the contribution into account). Use a tax rate of 20%.

Exercise 22

A company needs a new high tech machine. The company is considering purchasing or leasing the machine.

Purchase:
The machine can be purchased at a price of 1.500.000. The machine has a life of 4 years. The residual-value after is 300.000 after 4 years.

Lease:
The machine can be leased for the 4 years at a lease payment of 400.000 (prepaid).

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The discount rate in the company is 12% p.a. The tax rate is 20% while the tax depreciation rate is 20% also. The earnings and the cost are the same regardless if the machine is purchased or leased and can thus be disregarded.

Question 1
Calculate the net present value of the investment if the company choose to purchase and lease taking tax into account.

Question 2
Calculate the net present value of the investment if the company choose to purchase and lease not taking tax into account.

Exercise 23

A company is considering investing in a new machine. The machine has a cost of 550.000 and is expected to have a residual value of 40.000 after 5 years of use. The company can choose to either purchase or lease the machine.

The machine has a life of 5 years.

The company is expecting the following contributions from the investment:

Year	Contribution
1	150.000
2	170.000
3	180.000
4	150.000
5	150.000

If it is decided to lease the machine the lease details are as follows:

- Leasing period = 5 years
- Leasing payment = 130.000 (prepaid)
- There is no residual value because the company does not own the machine.

The discount rate in the company is 10% p.a. The tax rate is 20% while the tax depreciation rate is 20% also.

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Question 1
Calculate the net present value of the investment if the company choose to purchase and lease taking the contribution and tax into account.

Question 2
Calculate the net present value of the investment if the company choose to purchase and lease taking the contribution into account (no tax!).

Question 3
Calculate the net present value of the investment if the company choose to purchase and lease disregarding both the contribution and tax.



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