

# Invest for Excel®

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Financial modeling

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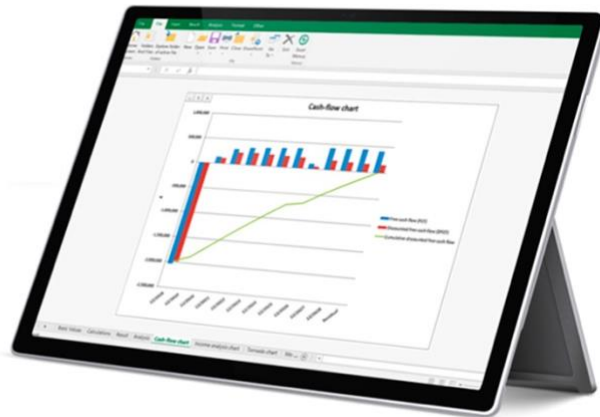
**Presented by** LEAPFROG CONSULT

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## Capital Budgeting, Financial Modeling and Valuation

Invest for Excel® helps thousands of businesses, nonprofits and their advisors drive better decision making through these time-tested processes.

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# Practical Hints for Investment Analysis

## Practical Hints for Investment Analysis

Everybody likes Tips & Tricks! In this section, we will present some useful hints that will help you create smart investment analysis.

**The topics:**

- 1. How to compare the profitability of projects with different economic life?**
- 2. What is Sensitivity Analysis and how to use it?**
- 3. How to model financing of the project?**
- 4. Two ways to deal with marginal effects of investments**
- 5. How to demonstrate extreme scenarios in Sensitivity analysis? You can include changes of several variables at the same time and create a chart**
- 6. How to handle Residual Values in Invest for Excel?**
- 7. Treatment of Working Capital**
- 8. Using own Excel sheets with Invest for Excel**
- 9. Goal-Seek function**
- 10. Mid-year discounting**
- 11. Automatic calculation vs Manual calculation**

**More topics to come soon!**

### **1. How to compare the profitability of projects with different economic life?**

As the NPVs of two or more investments with different economic life are not directly comparable, a monthly annuity payment of NPV can be used as the basis for comparison. The decision-making rule: The higher the monthly annuity payment, the better the investment is.

Annuity payments are a series of future constant payments based on a constant discounting rate so that the sum of their present value is equal to the project's NPV.

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### For example:

What is the yearly annuity of this project, calculated against its NPV?

	Present moment	Year 1	Year 2
Free Cash Flows	-100	70	120

$$\text{NPV} = -100 + 70/((1+10\%)^1) + 120/((1+10\%)^2) = 63$$

### Answer:

The yearly annuity for this project constituting of 2 payments in year 1 and year 2 is 36, as:

$$36/((1+10\%)^1) + 36/((1+10\%)^2) = 63 = \text{NPV}$$

Annuity payments corresponding to the Example Project:

	Present moment	Year 1	Year 2
Yearly Annuity Payments	0	36	36

### Exercise with us!

We need to compare two investment alternatives, one with the economic life of 3 years and the other – of 4 years. Let's determine projects' NPVs.

#### PROJECT 1:

Annual discount rate = 2,75%

	Present moment	Year 1	Year 2	Year 3
FCF	-10 000	10 000	9 000	12 000

$$\text{NPV} = 19\,319$$

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PROJECT 2:

Annual discount rate = 2,75%

	Present moment	Year 1	Year 2	Year 3	Year 4
FCF	-12 000	7000	8 000	8 000	14 000

NPV = 22 325

The Project 2 returns higher NPV, however, it also lasts 1 year longer in comparison to Project 1. With the Invest for Excel® software, it is easy to determine the monthly annuity and use it as the proper comparison indicator.

Project description	Project 1	Project 2
Nominal value of all investments	<b>10 000</b>	<b>12 000</b>
Required rate of return	<b>2,75%</b>	<b>2,75%</b>
Calculation term	<b>3,0</b>	<b>4,0</b>
Calculation term		
Calculation point	1/2012	1/2012
Interval length (months)	12	12
PV of operative cash flow	29 319	34 325
PV of residual value	0	0
Present value of business cash flows	29 319	34 325
Present value of reinvestments (maintenance etc.)	0	0
<b>Total Present Value (PV)</b>	<b>29 319</b>	<b>34 325</b>
Proposed investments in assets	-10 000	-12 000
Investment subventions	0	0
Investment proposal	-10 000	-12 000
<b>Net Present Value (NPV)</b>	<b>19 319</b>	<b>22 325</b>
NPV as a monthly annuity	559	491

The calculation shows that despite lower NPV, the monthly annuity is higher of the Project 1!

[Download the Invest for Excel® test version](#) now and test it for proper comparisons of the projects with different life-cycles. You can use the above example as your exercise! If you have any questions, please contact us and we will be glad to help.

## 2. What is Sensitivity Analysis and how to use it?

### Introduction

Sensitivity analysis is aimed at reducing the uncertainty in the evaluation of investment models. Usually, sensitivity analyses are calculations for studying how alternative assumptions in the various variables affect profitability. The analysis can be used for studying when an investment becomes unprofitable or which assumptions make a difference between two profitable alternatives with regard to their profitability.

Sensitivity analyses give an idea how the profitability of an investment project is affected by changing certain basic assumptions or values (e.g. the acquisition cost increases by 10%, or variable costs decrease by 5%).

We will present here the most common ways of performing sensitivity analysis in investment models or business projects. We will not include in this article the probabilistic methods that require more insightful explanation.

### Single-parameter sensitivity analysis

Single-parameter sensitivity analysis helps to reveal the impact how changes in a certain parameter affect the total model results.

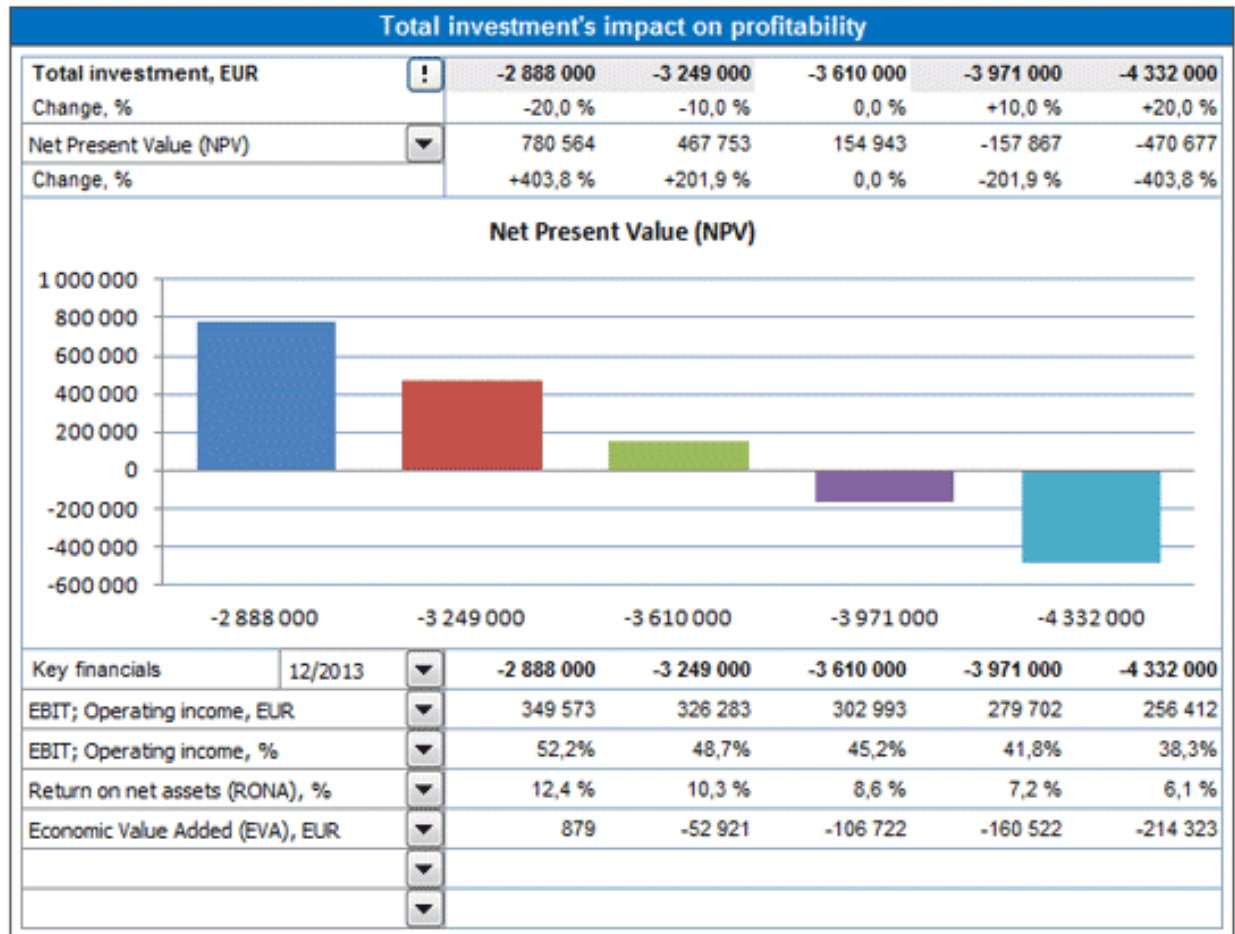
- ***In-built charts***

In Invest for Excel software, the ready spreadsheet called Analysis is present in all calculation files. It displays the charts range that shows sensitivity of key variables (one variable at the time): Discount rate, total investments, income, variable costs, fixed costs, specific parameter of income variables can be additionally selected by the user.

The outcome results can also be selected by the reviewer – for example: NPV, IRR, MIRR, Payback, DCVA and more.

For example:

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Picture 1: The sensitivity analysis chart inbuilt in every calculation file of Invest for Excel software.

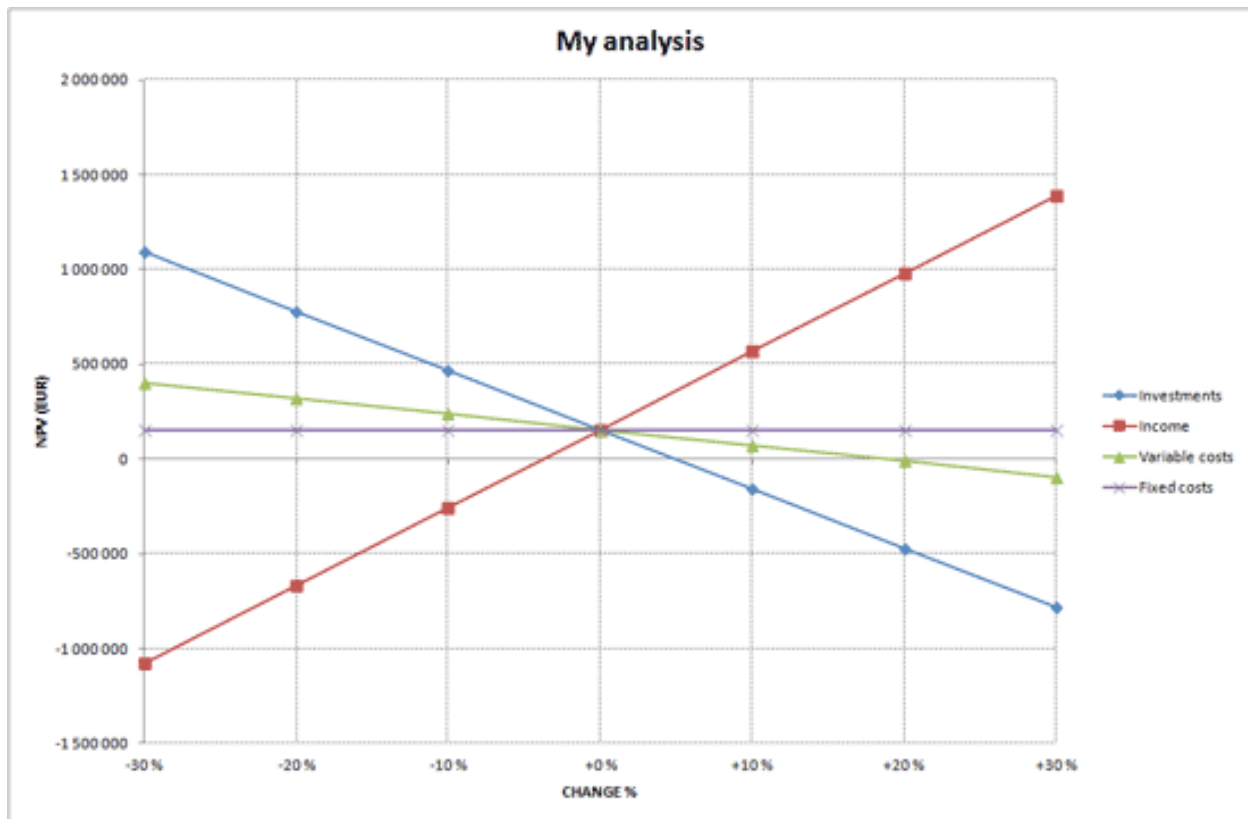
- **Sensitivity analysis - Spider diagram**

It helps to determine which are the key drivers that shape the model outcome. The customized charts can be easily created by the user via opening a dialog window and selecting desired parameters for analysis.

There will be automatically a new spreadsheet added with the customized sensitivity chart.

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For example:



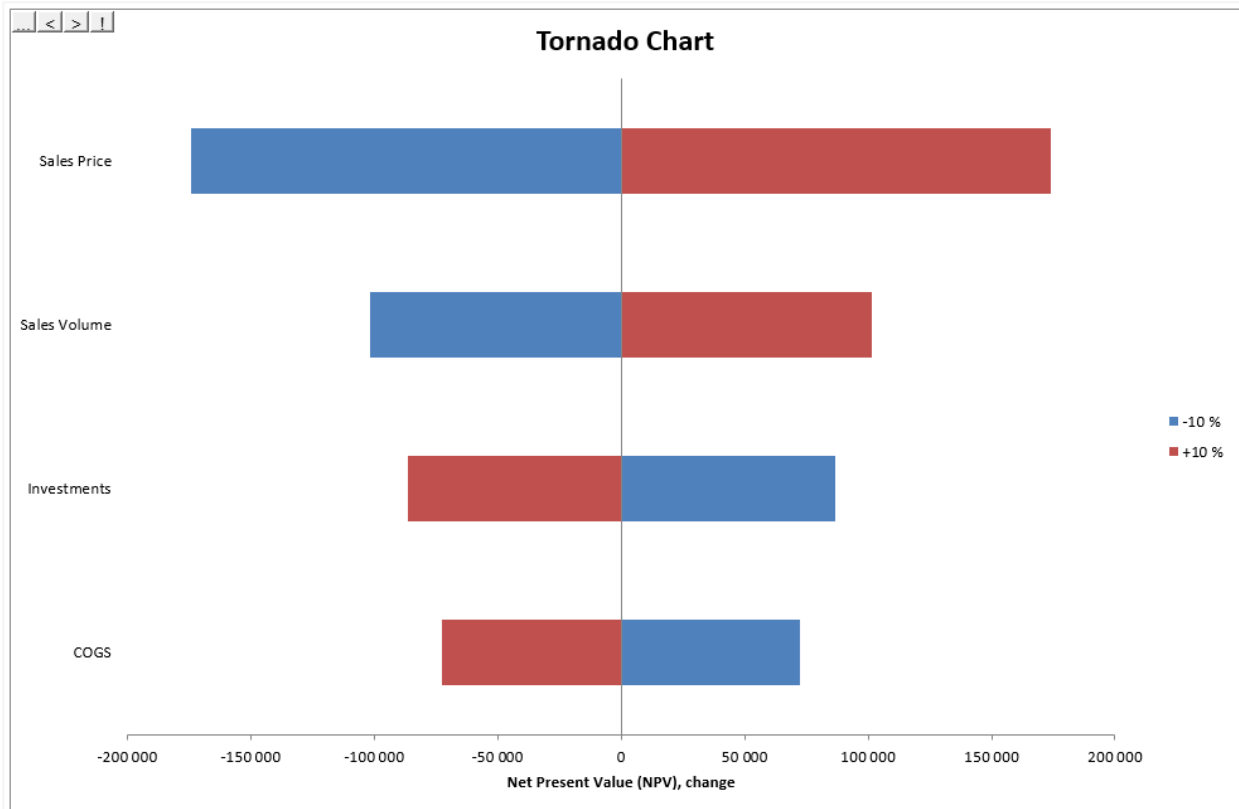
Picture 2: Spider diagram – impact of variables with up to 30% change on NPV

The chart above shows that a 15% drop in production output leads to negative NPV. The chart also shows that the NPV still would be positive although variable- or fixed costs would increase with 30%.

- **Sensitivity analysis - Tornado diagram**

The Tornado chart demonstrates the impact that a fixed change in each parameter has on the main model results. Both the input and output parameters can be selected by the user. For example, this diagram clearly depicts that Income variable has the greatest influence on determining project's NPV.

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Picture 3: Tornado diagram – how the change of variables by 10% impacts the outcome: NPV

- **Break-even function – important sensitivity feature**

By running the Break-Even function, you can quickly calculate the break-even point of the investment on any input parameter - for example how much certain incomes can drop, or costs rise, while the NPV falls to zero level, meaning that if implemented with the given target interest rate, the investment would, theoretically, only just be feasible.

Example:

What is the minimum price (break-even), so that project stays profitable (NPV = 0)?



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	9/2011	10/2011	11/2011	12/2011	12/2012	12/2013	12/2014
Investments	-1 500 000	-500 000	-150 000	-150 000	0	50 000	0
Realizations							0
Depreciation							188
Realization profit (+) / loss (-)							-225 266
Book value							0
							896
							1 939 630
<b>INCOME STATEMENT</b>							
Euro							
Months per interval							12
Income specified:							
Sales	945 000	984 327	984 049	1 004 175	15 363 876	19 588 942	24 975 900
Capacity / month	9 000	9 000	9 000	9 000	108 000	108 000	108 000
Utilization rate	30,0 %	30,6 %	31,1 %	31,7 %	39,7 %	49,6 %	62,0 %
Price / meter	350,00	350,58	351,16	351,74	358,77	365,95	373,27

Picture 4: Searching break-even value for Price parameter

The break-even value was found for Price parameter. It is important to notice that the parameter level for all periods over the time was found, not just for the first period:

<b>INCOME STATEMENT</b>							
Euro							
	9/2011	10/2011	11/2011	12/2011	12/2012	12/2013	12/2014
Months per interval	1	1	1	1	12	12	12
Income specified:							
Sales	391 040	399 038	407 199	415 527	6 357 557	8 105 885	10 335 003
Capacity / month	9 000	9 000	9 000	9 000	108 000	108 000	108 000
Utilization rate	30,0 %	30,6 %	31,1 %	31,7 %	39,7 %	49,6 %	62,0 %
Price / meter	144,83	145,07	145,31	145,55	148,46	151,43	154,46

Picture 5: Break-even value for Price parameter is found and relevant for all calculation periods.

### Multiple-parameter sensitivity analysis

Such analysis allows for examining the relationship of two or more different parameters changing at the same time, at a given range that can vary individually per each parameter. It shows how each potential combination of the changed parameters affect the model's results. The reviewer can determine this way the results of most optimistic scenario, the most pessimistic scenario and all the range of options between those extremes.

While using Invest for Excel® software, the user can utilise standard MS Excel environment with calculation files created in the software. The multiple-parameter sensitivity analysis is supported by Scenarios Manager function.

Example:

This analysis depicts how 2 parameters changing simultaneously (price and efficiency) affect profitability result: NPV and IRR.

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Scenario Summary		Current Values:	price -5% efficiency -1%	price +5% efficiency +1%	price -10% efficiency -2%
<b>Changing Cells:</b>					
Price		250	237,5	262,5	225
Efficiency		90%	89%	91%	88%
<b>Result Cells:</b>					
npv		6 642 097	5 267 627	8 014 405	3 890 930
irr		21,90%	19,34%	24,29%	16,57%

Picture 6: Multiple-parameter sensitivity analysis table

[Download the Invest for Excel® test version](#) now and test it for multi-range of sensitivity analysis!

If you have any questions, please contact us and we will be glad to help: Phone: +358 19 54 10 100, E-mail: [info@datapartner.fi](mailto:info@datapartner.fi)

### 3. How to model financing of the project?

While taking decision on how to finance a project, there are many typical questions that need to be addressed:

- How much financing is needed?
- What type of loan will be the most appropriate (annuity, equal amortizations, bullet, customized repayment scheme)?
- What repayment period is feasible (and which one is certainly not)?
- How to model drawdown, repayment, financing costs of a loan and integrate it to the cash flow of the project?
- Is there an effect on tax?
- What is an effect on financial statements of adding financing (Cash flow, Balance Sheet etc.)?

With Invest for Excel® software, all these questions can be answered in minutes as the Enterprise edition includes a **Financing module** that helps to develop suitable financing scheme as well as integrate it with the investment calculation. The financing module includes such valuable features as:

- Based on input of several loan parameters, the whole financing plan is created "on click" with exact cash flows of withdrawals, fees, interest and debt change, incorporating capability for various currencies, floating rates, various types of loans, consolidation of loans and more.
- The Financing model can be exported to Investment Calculation "on click" and the Financial Statements of the Investment calculation are updated accordingly. For example Income Statement with the Financing

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Items, Balance Sheet with the Debt Change, Cash Flow Statement with all debt service. The tax effects of Financing items or capitalization of financing expenses can be also included – as standard options.

- The financing files of Invest for Excel® can be used as a loan register.

When planning financing, we should start by analyzing the Project Cash Flow (View: Cash flow Statement in the Investment File). Example:

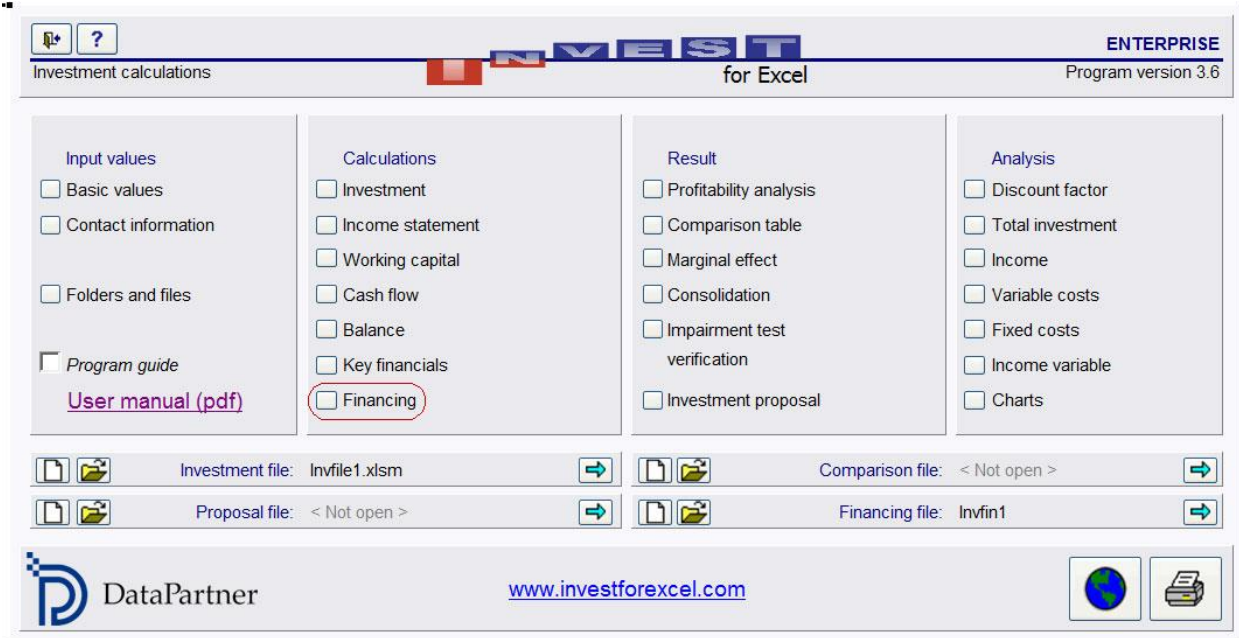
CASH FLOW STATEMENT							
	1/2012	12/2012	12/2013	12/2014	12/2015	12/2016	Residual
Months per interval		12	12	12	12	12	(12/2016)
<b>Cash flow from operations</b>							
Income	0	7 000	9 000	9 360	9 734	10 124	0
Variable costs	0	-2 000	-3 000	-3 090	-3 183	-3 278	0
Fixed costs	0	-1 000	-1 000	-1 000	-1 000	-1 000	0
Extraordinary income & expenses	0	0	0	0	0	0	0
Income tax	0	-760	-950	-1 001	-1 055	-1 111	0
Change in working capital	0	0	0	0	0	0	0
<b>Cash flow from operations</b>	<b>0</b>	<b>3 240</b>	<b>4 050</b>	<b>4 269</b>	<b>4 497</b>	<b>4 735</b>	<b>0</b>
Asset investments and realizations	-12 000	0	0	0	0	0	0
<b>Free cash flow (FCF)</b>	<b>-12 000</b>	<b>3 240</b>	<b>4 050</b>	<b>4 269</b>	<b>4 497</b>	<b>4 735</b>	<b>0</b>
Discounted free cash flow (DFCF)	-12 000	2 945	3 347	3 207	3 071	2 940	0
Cumulative discounted free cash flow	-12 000	-9 055	-5 707	-2 500	571	3 511	3 511
<b>Information</b>							
<b>Financial cash flow</b>							
Financial income and expenses	0	0	0	0	0	0	0
Correction of income tax for financial items	0	0	0	0	0	0	0
Long-term debt, increase (+) / decrease (-)	0	0	0	0	0	0	0
Changes in short-term borrowings							
Equity, increase (+) / decrease (-)	1 000	0	0	0	0	0	0
<b>Total cash flow</b>	<b>-11 000</b>	<b>3 240</b>	<b>4 050</b>	<b>4 269</b>	<b>4 497</b>	<b>4 735</b>	<b>0</b>
Cumulative total cash flow	-11 000	-7 760	-3 710	559	5 056	9 791	9 791

Picture 1. Cash flow statement of a project (Investment file)

The Cumulative total cash flow – the last line of the statement shows the need of debt financing of 11 000 for 1/2012. It is time to open Financing module and start analyzing financing alternatives.

From the Homescreen of Invest for Excel® program, select Financing and create a new File.

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Picture 2. Homescreen of Invest for Excel® software with the available menu of functionalities.

The Financing file can be updated with the Project cash flow from the Investment file, just with one click.

The financing file has a convenient structure that allows the user to easily navigate and input all necessary parameters such as drawdown, interest, fees, time of repayment etc.

Below, there is an example how the parameters have been chosen for financing the project case study.

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Type of financing...	Commercial Loan		Remove this financing
Project	Project 1		
Financing description	A loan for financing investment, constitutes 92% of investment, repayment plan: 2,5 years		
Total amount	11 000 EUR	Currency	EUR <input type="button" value="Enter withdrawals -&gt;"/>
% of total financing	100 %		
Financial closing	Month	12	Year 2011 12/2011
Drawdown period	Months	0	12/2011 - 12/2011 (0 years)
Repayment period	Years	2	+ months 6
	Starts at	A: Financial closing	12/2011 - 6/2014 (2,5 years)
Financing type	A: Equal amortizations	<input type="checkbox"/> Balloon payment	<input type="button" value="Enter balloon -&gt;"/>
Amortization interval	Months	1	<input type="button" value="Enter principal payments -&gt;"/>
Interest based on			
Drawdown period interest	B: Paid from first draw according to interest payment interval		
Interest	Fixed/floating		
Interest rate (p.a.)	6,00000 %	Fixed	<input type="button" value="Enter interest rate changes -&gt;"/>
Interest margin (p.a.)	1,00000 %		
Total rate (p.a.)	7,00000 %		
Yield (p.a.)	7,22901 %		
	Interest payment interval	1	months 360 days
	(Repayment period)		

Picture 3. Parameters of the loan (Financing file)

Loan parameters:

- Interest rate: 6%
- Margin: 1%
- Type of loan: Equal amortizations
- Drawdown on financial closing: 12/2011
- Repayment: 2,5 year

After entering loan withdrawal, the fees, loan interest and loan principal repayments are calculated.



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Figures:		EUR	Investment	Total amount:	11 000	Interest (fixed)					< bs		IRR:	7,8636%		
(All transactions at end of month)	Month	Totals:	Per period	Withdrawals	Capitalized interest	Principal payment	Ending balance	Rate	Calculated	Accrued	Bank fee	Fees	Financing cash flow			
				EUR	% of total						Calculated	Paid	Total	Cash flow	Cumulative	
	0	12/2011	0,00	11 000,00	100,00	0,00	11 000,00	0,00	1 157,09	1 157,09	1 157,09	110,00	110,00	110,00	-1 267,09	-1 267,09
	1	1/2012	-11 000,00			0,00	213,08	10 786,92	7,00000	64,17	64,17	0,00	110,00	110,00	-323,08	10 676,92
	2	2/2012	0,00			0,00	220,54	10 566,37	7,00000	62,92	127,09	0,00	0,00	0,00	-220,54	10 456,37
	3	3/2012	0,00			0,00	228,26	10 338,11	7,00000	61,64	188,73	0,00	0,00	0,00	-228,26	10 228,11
	4	4/2012	0,00			0,00	236,25	10 101,86	7,00000	60,31	249,03	0,00	0,00	0,00	-236,25	9 991,86
	5	5/2012	0,00			0,00	244,52	9 857,34	7,00000	58,93	307,96	0,00	0,00	0,00	-244,52	9 747,34
	6	6/2012	0,00			0,00	253,08	9 604,26	7,00000	57,50	365,46	365,46	0,00	0,00	-618,54	9 128,80
	7	7/2012	0,00			0,00	261,94	9 342,33	7,00000	56,02	421,49	0,00	0,00	0,00	-261,94	8 866,87
	8	8/2012	0,00			0,00	271,10	9 071,22	7,00000	54,50	475,98	0,00	0,00	0,00	-271,10	8 595,76
	9	9/2012	0,00			0,00	280,59	8 790,63	7,00000	52,92	528,90	0,00	0,00	0,00	-280,59	8 315,17
	10	10/2012	0,00			0,00	290,41	8 500,22	7,00000	51,28	580,18	0,00	0,00	0,00	-290,41	8 024,76
	11	11/2012	0,00			0,00	300,58	8 199,64	7,00000	49,58	629,76	0,00	0,00	0,00	-300,58	7 724,18
	12	12/2012	3 240,00			0,00	311,10	7 888,55	7,00000	47,83	677,59	312,13	0,00	0,00	-623,23	7 100,95
	13	1/2013	0,00			0,00	321,99	7 566,56	7,00000	46,02	723,61	0,00	0,00	0,00	-321,99	6 778,97
	14	2/2013	0,00			0,00	333,26	7 233,31	7,00000	44,14	767,75	0,00	0,00	0,00	-333,26	6 445,71
	15	3/2013	0,00			0,00	344,92	6 888,39	7,00000	42,19	809,94	0,00	0,00	0,00	-344,92	6 100,79
	16	4/2013	0,00			0,00	356,99	6 531,40	7,00000	40,18	850,12	0,00	0,00	0,00	-356,99	5 743,80
	17	5/2013	0,00			0,00	369,49	6 161,91	7,00000	38,10	888,22	0,00	0,00	0,00	-369,49	5 374,32
	18	6/2013	0,00			0,00	382,42	5 779,49	7,00000	35,94	924,17	246,58	0,00	0,00	-628,99	4 745,32
	19	7/2013	0,00			0,00	395,80	5 383,69	7,00000	33,71	957,88	0,00	0,00	0,00	-395,80	4 349,52
	20	8/2013	0,00			0,00	409,66	4 974,03	7,00000	31,40	989,29	0,00	0,00	0,00	-409,66	3 939,86
	21	9/2013	0,00			0,00	423,99	4 550,04	7,00000	29,02	1 018,30	0,00	0,00	0,00	-423,99	3 515,87
	22	10/2013	0,00			0,00	438,83	4 111,21	7,00000	26,54	1 044,94	0,00	0,00	0,00	-438,83	3 077,04
	23	11/2013	0,00			0,00	454,19	3 657,01	7,00000	23,98	1 068,83	0,00	0,00	0,00	-454,19	2 622,85
	24	12/2013	4 050,00			0,00	470,09	3 186,93	7,00000	21,33	1 090,16	165,99	0,00	0,00	-636,08	1 986,77
	25	1/2014	0,00			0,00	486,54	2 700,38	7,00000	18,59	1 108,75	0,00	0,00	0,00	-486,54	1 500,22
	26	2/2014	0,00			0,00	503,57	2 196,81	7,00000	15,75	1 124,50	0,00	0,00	0,00	-503,57	996,65
	27	3/2014	0,00			0,00	521,20	1 675,62	7,00000	12,81	1 137,32	0,00	0,00	0,00	-521,20	475,46
	28	4/2014	0,00			0,00	539,44	1 136,18	7,00000	9,77	1 147,09	0,00	0,00	0,00	-539,44	-63,98
	29	5/2014	0,00			0,00	558,32	577,86	7,00000	6,63	1 153,72	0,00	0,00	0,00	-558,32	-622,30
	30	6/2014	0,00			0,00	577,86	0,00	7,00000	3,37	1 157,09	66,93	0,00	0,00	-644,79	-1 267,09
		Totals:	5 055,58	11 000,00	100,00	0,00	11 000,00	0,00	1 157,09	1 157,09	1 157,09	110,00	110,00	110,00	-1 267,09	-1 267,09
		Drawdown period									0,00	0,00	0,00	0,00	11 000,00	
		Repayment period									1 157,09	110,00	110,00		-12 267,09	

Picture 4. The detailed specification of the loan withdrawal, interest, fees, repayment and also project cash flows – view month by month (Financing file)

Several summary reports are generated, such as:

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### Project 1

Figures		12/2011	1/2012 - 12/2012	1/2013 - 12/2013	1/2014 - 6/2014	12/2011 - 6/2014
EUR	...					
Number of months		0	12	12	6	30
Period		Fin. closing	Repayment period (2,5 years)			Total
Total financing		11 000				
Starting balance		0	11 000	7 889	3 187	
Withdrawals	a)	11 000	0	0	0	11 000
Capitalized interest		0	0	0	0	0
Principal payments	b)	0	3 111	4 702	3 187	11 000
Ending balance		11 000	7 889	3 187	0	
Interest expense	c)	0	678	413	67	1 157
Bank fee		0	110	0	0	110
Total fees	d)	0	110	0	0	110
Total debt service	(b+c+d)	0	3 899	5 114	3 254	12 267
Total cash flow	(a-b-c-d)	11 000	-3 899	-5 114	-3 254	-1 267
Cumulative cash flow		11 000	7 101	1 987	-1 267	

All-in rate (p.a.)

Total finance cost

(Total interest and fees paid)

Picture 5. Summary view (Financing file)

When the financing cash-flows are determined, the next step is to combine them with the project cash flows and verify if the selected option is feasible. No need of copying or moving the columns or even linking the files. It is easy to update Investment calculation file with projected financing using the button with the red exclamation mark. Done!

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### CASH FLOW STATEMENT

	1/2012	12/2012	12/2013	12/2014	12/2015	12/2016	Residual
Months per interval		12	12	12	12	12	(12/2016)
<b>Cash flow from operations</b>							
Income	0	7 000	9 000	9 360	9 734	10 124	0
Variable costs	0	-2 000	-3 000	-3 090	-3 183	-3 278	0
Fixed costs	0	-1 000	-1 000	-1 000	-1 000	-1 000	0
Income tax (adjusted)	0	-760	-950	-1 001	-1 055	-1 111	0
<b>Cash flow from operations</b>	<b>0</b>	<b>3 240</b>	<b>4 050</b>	<b>4 269</b>	<b>4 497</b>	<b>4 735</b>	<b>0</b>
Asset investments and realizations	-12 000	0	0	0	0	0	0
<b>Free cash flow (FCF)</b>	<b>-12 000</b>	<b>3 240</b>	<b>4 050</b>	<b>4 269</b>	<b>4 497</b>	<b>4 735</b>	<b>0</b>
Discounted free cash flow (DFCF)	-12 000	2 945	3 347	3 207	3 071	2 940	0
Cumulative discounted free cash flow	-12 000	-9 055	-5 707	-2 500	571	3 511	3 511
<b>Financial cash flow</b>							
Financial income and expenses	0	-829	-367	-51	0	0	0
Correction of income tax for financial items	0	157	70	10	0	0	0
Long-term debt, increase (+) / decrease (-)	11 000	-4 400	-4 400	-2 200	0	0	0
Changes in interest-bearing long-term debt	11 000	-4 400	-4 400	-2 200	0	0	0
Changes in long-term debt, Financing file	11 000	-4 400	-4 400	-2 200	0	0	0
Equity, increase (+) / decrease (-)	1 000	0	0	0	0	0	0
<b>Total cash flow</b>	<b>0</b>	<b>-1 831</b>	<b>-647</b>	<b>2 027</b>	<b>4 497</b>	<b>4 735</b>	<b>0</b>
Cumulative total cash flow	0	-1 831	-2 478	-451	4 046	8 781	8 781

Picture 6. Cash flow statement of the project, including financing – option 1 (Investment file)

The changes in debt and financing costs are highlighted with light-blue colour. As the cash flow statement depicts it, the choice of financing is unsatisfactory in that case. In the first years the project has negative cumulative cash flow, which may suggest that the desired repayment period of 2,5 years is too short.

Let's extend the loan repayment to 4 years and find out if this type of financing is suitable.

### CASH FLOW STATEMENT

	1/2012	12/2012	12/2013	12/2014	12/2015	12/2016	Residual
Months per interval		12	12	12	12	12	(12/2016)
<b>Cash flow from operations</b>							
Income	0	7 000	9 000	9 360	9 734	10 124	0
Variable costs	0	-2 000	-3 000	-3 090	-3 183	-3 278	0
Fixed costs	0	-1 000	-1 000	-1 000	-1 000	-1 000	0
Income tax (adjusted)	0	-760	-950	-1 001	-1 055	-1 111	0
<b>Cash flow from operations</b>	<b>0</b>	<b>3 240</b>	<b>4 050</b>	<b>4 269</b>	<b>4 497</b>	<b>4 735</b>	<b>0</b>
Asset investments and realizations	-12 000	0	0	0	0	0	0
<b>Free cash flow (FCF)</b>	<b>-12 000</b>	<b>3 240</b>	<b>4 050</b>	<b>4 269</b>	<b>4 497</b>	<b>4 735</b>	<b>0</b>
Discounted free cash flow (DFCF)	-12 000	2 945	3 347	3 207	3 071	2 940	0
Cumulative discounted free cash flow	-12 000	-9 055	-5 707	-2 500	571	3 511	3 511
<b>Financial cash flow</b>							
Financial income and expenses	0	-889	-559	-339	-119	0	0
Correction of income tax for financial items	0	169	106	64	23	0	0
Long-term debt, increase (+) / decrease (-)	11 000	-2 750	-2 750	-2 750	-2 750	0	0
Changes in interest-bearing long-term debt	11 000	-2 750	-2 750	-2 750	-2 750	0	0
Changes in long-term debt, Financing file	11 000	-2 750	-2 750	-2 750	-2 750	0	0
Equity, increase (+) / decrease (-)	1 000	0	0	0	0	0	0
<b>Total cash flow</b>	<b>0</b>	<b>-230</b>	<b>847</b>	<b>1 244</b>	<b>1 650</b>	<b>4 735</b>	<b>0</b>
Cumulative total cash flow	0	-230	617	1 861	3 511	8 246	8 246

Picture 7. Cash flow statement of the project, including financing – option 2 (Investment file)



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As a result, the cumulative total cash flow is still slightly negative. There can be several solutions: the type of repayment can be changed from equal amortizations to annuity, the repayment period extended or simply the amount of financing should be slightly increased, to be prepared for the upcoming interest. Below, the first option is selected and it shows that the change of a loan type to annuity, with 4 years repayment period is a good plan for financing this project. The Cumulative total cash flow is positive, which states that the financing is sufficient.

CASH FLOW STATEMENT							
	1/2012	12/2012	12/2013	12/2014	12/2015	12/2016	Residual
Months per interval		12	12	12	12	12	(12/2016)
<b>Cash flow from operations</b>							
Income	0	7 000	9 000	9 360	9 734	10 124	0
Variable costs	0	-2 000	-3 000	-3 090	-3 183	-3 278	0
Fixed costs	0	-1 000	-1 000	-1 000	-1 000	-1 000	0
Income tax (adjusted)	0	-760	-950	-1 001	-1 055	-1 111	0
<b>Cash flow from operations</b>	<b>0</b>	<b>3 240</b>	<b>4 050</b>	<b>4 269</b>	<b>4 497</b>	<b>4 735</b>	<b>0</b>
Asset investments and realizations	-12 000	0	0	0	0	0	0
<b>Free cash flow (FCF)</b>	<b>-12 000</b>	<b>3 240</b>	<b>4 050</b>	<b>4 269</b>	<b>4 497</b>	<b>4 735</b>	<b>0</b>
Discounted free cash flow (DFCF)	-12 000	2 945	3 347	3 207	3 071	2 940	0
Cumulative discounted free cash flow	-12 000	-9 055	-5 707	-2 500	571	3 511	3 511
<b>Financial cash flow</b>							
Financial income and expenses	0	-902	-590	-372	-135	0	0
Correction of income tax for financial items	0	171	112	71	26	0	0
Long-term debt, increase (+) / decrease (-)	11 000	-2 430	-2 632	-2 851	-3 087	0	0
Changes in interest-bearing long-term debt	11 000	-2 430	-2 632	-2 851	-3 087	0	0
Changes in long-term debt, Financing file	11 000	-2 430	-2 632	-2 851	-3 087	0	0
Equity, increase (+) / decrease (-)	1 000	0	0	0	0	0	0
<b>Total cash flow</b>	<b>0</b>	<b>79</b>	<b>940</b>	<b>1 117</b>	<b>1 300</b>	<b>4 735</b>	<b>0</b>
Cumulative total cash flow	0	79	1 019	2 135	3 436	8 170	8 170

Picture 8. Cash flow statement of the project, including financing – option 3 (Investment file)

With financing cash flows integrated with the investment cash flows, it is possible to analyze the project's profitability from the FCFE viewpoint and get the leverage effect on NPV to Equity. The risk vs. return of financing can be assessed.

The debt may be aggregated from several loans. You can add loans by pressing the "Add financing.." - button.

Financing Module is available in the Enterprise edition of Invest for Excel®.

If you have any questions, please contact us and we will be glad to help you: Phone:+358 19 54 10 100, E-mail: [info@datapartner.fi](mailto:info@datapartner.fi)

## 4. Two ways to deal with marginal effects of investments

Very often an investment is of the kind that it in some form improves current operations. It may save in costs for energy, raw materials, personnel or logistics. It may increase capacity or quality. Anyway the effect of the investment is marginal. How to calculate the effect it brings?

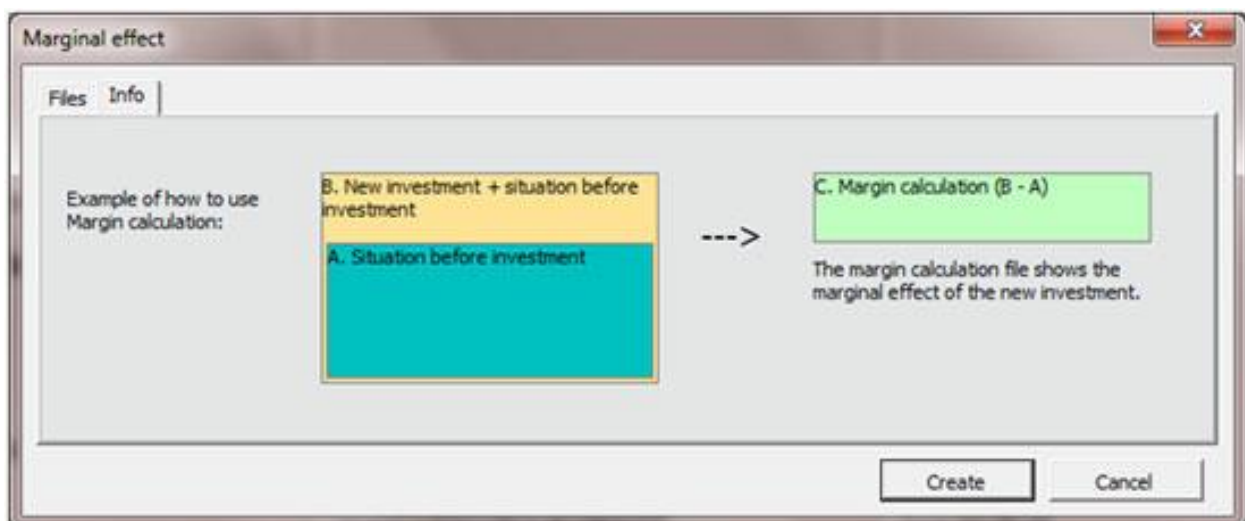
### Way one

1) Typically a marginal investment calculation is done. Example: A production facility consumes a substantial amount of electricity. A 100 000 Euro additional investment in energy saving equipment would give a power saving of 30 000 Euros per year in 5 years. A simple calculation gives an IRR of 15,24% before taxes. Fair enough, but reality is seldom this simple.

Wouldn't the power saving be depending on production volumes? Would the installation of this equipment cause a break in production? Would the additional investment affect other costs? How would it affect working capital and taxes?

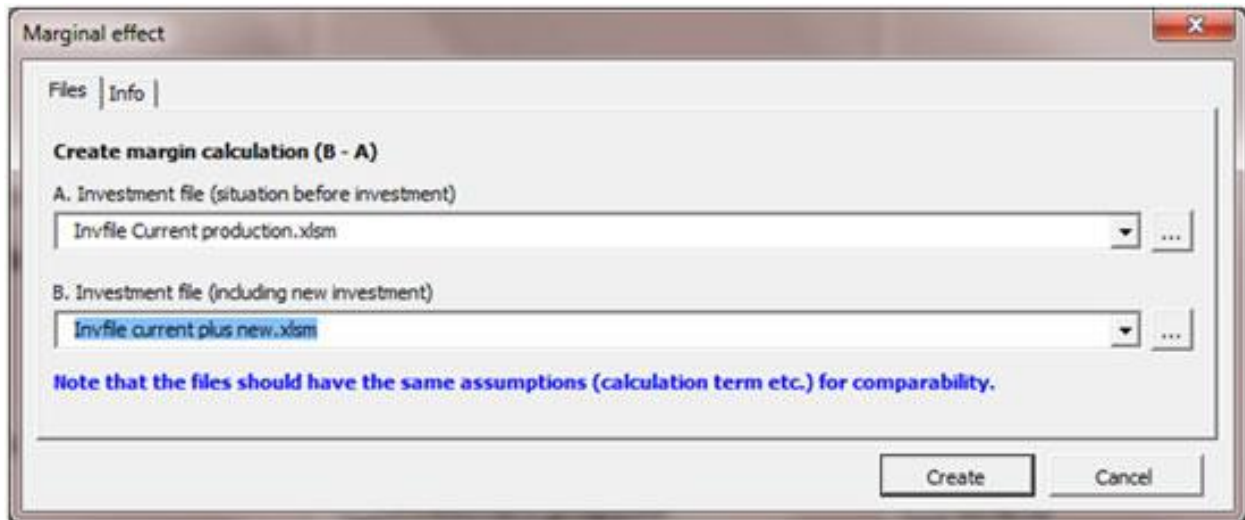
### Way two

2) The alternative way is to deal with "the whole picture". First, model your current operations. Then save the calculation file with a new name. Include the additional investment and all its effects carefully to this calculation file, so that the effects are depending on volumes etc. Then use the "Marginal effect" function in Invest for Excel® software to create a comparison calculation:

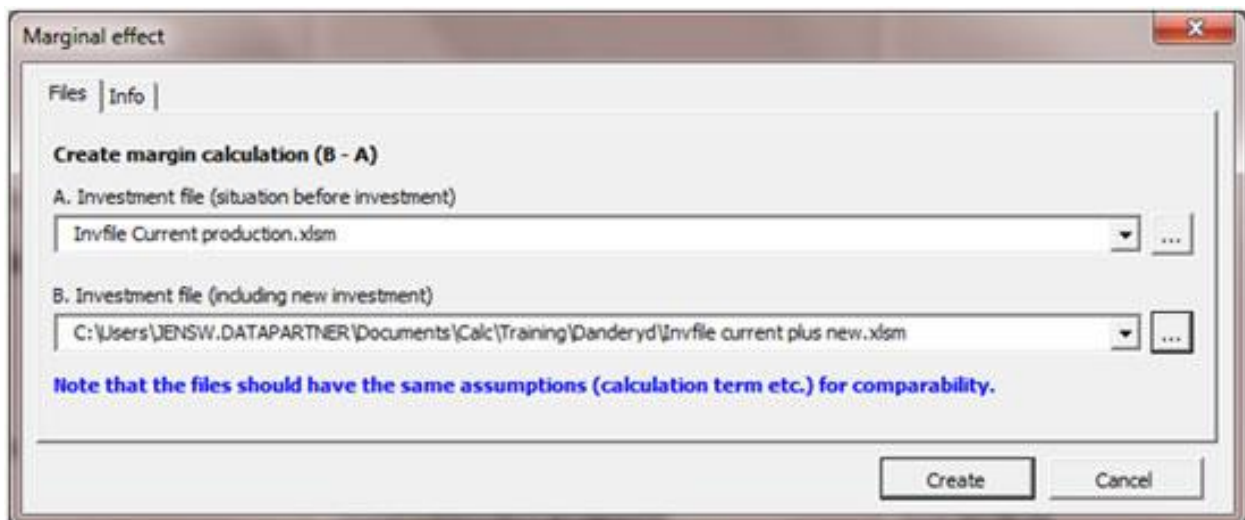


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In the upper "A"-field, select the calculation file of current production, without additional investment. In the lower "B"-field, select the calculation file including additional investments.



Open files can be selected with the drop down menu (arrow on the right). Saved files can be selected by pressing the button with three dots, on the right side:



Note that the two files compared should have the same discount rate, calculation term and tax assumptions for comparability.

When you press Create -button a third calculation file will be created automatically. This will be the marginal investment calculation. This new calculation would then be the investment appraisal for the new investment, showing only the marginal changes. Basically the result should be exactly the same as the handmade marginal calculation, Example 1, in the beginning of this article. However, sometimes working with the

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"whole picture" gives a more exact result. It is because it brings more aspects for considerations and helps avoid simplifications. This functionality makes it easier to create marginal calculations in complex situations. This is the most common way to calculate investments in process industries and manufacturing.

Another advantage of this method is that you also can compare "current situation" with "current plus new investment" using Comparison table function in Invest for Excel® software.

If you have any questions, please contact us and we will be glad to help you: Phone:+358 19 54 10 100, E-mail: [info@datapartner.fi](mailto:info@datapartner.fi)

### 5. How to demonstrate extreme scenarios in Sensitivity analysis? You can include changes of several variables at the same time and create a chart

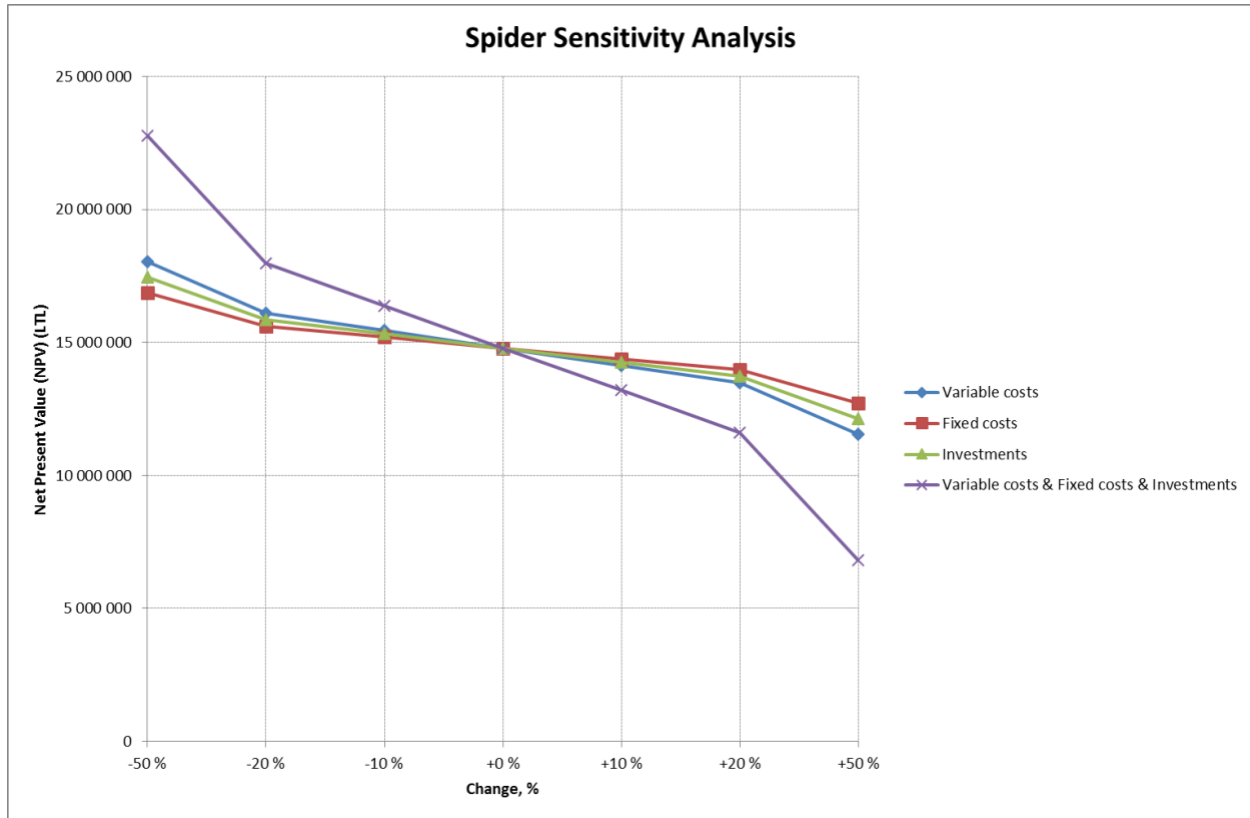
The sensitivity analysis charts typically display the change for **only one variable** at a time and the assumption is that the rest of variables stay unchanged. For example: what if investments increase +/- 10% and all other variables such as costs or incomes are without any changes.

Invest for Excel is helpful in demonstrating extreme effects in What-if Analysis, considering the impact of several variables altogether.

"Show line with all changes combined" option is available in the Spider analysis chart.

It is possible to combine the effects of sensitivity changes on **up to 5 variables** selected by the user. As a result, the line chart showing all the changes combined will be displayed in addition to the one-variable sensitivity line charts. In the below example, the line chart showing all the changes combined is of the violet colour and includes +/- changes of: Variable costs AND Fixed costs AND Investments altogether, providing the overview of the project profitability in extreme positive and negative scenarios.

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Available in the software compilation 3.6018 and newer.

## 6. How to handle Residual Values in Invest for Excel®

### Residual Value

An important question to consider when making investment calculations is the *Residual Value*. The *Residual Value* is how much a fixed asset is worth at the end of its useful life. The term *Salvage Value* is used in accounting. *Salvage Value* is the estimated value that an asset will realize upon its sale at the end of its useful life. The value is used in accounting to determine depreciation amounts or can be determined by a regulatory body such as the IRS. However the *Asset Book Value* at the end of the calculation period used when making financial projections typically differ from the market value. Thus you need to adjust the Residual Value in the Residual column of Invest for Excel®.

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INVESTMENTS (-) / REALIZATIONS (+)		7/2014	9/2014	12/2014	12/2015	12/2016	12/2017	12/2018	12/2019	Residual
Months per interval			3	3	12	12	12	12	12	(12/2019)
Machines & equipment										
1 Machines		-500 000	-500 000	-500 000						350 000
Depreciation (straight line)	10,00%				-150 000	-150 000	-150 000	-150 000	-150 000	
Book value		500 000	1 000 000	1 500 000	1 350 000	1 200 000	1 050 000	900 000	750 000	0
2 Maintenance investment										0
Depreciation (straight line)	33,33%									
Book value		0	0	0	0	0	0	0	0	0
Buildings and Structures										
3 Building		-100 000	-200 000	-200 000						500 000
Depreciation (straight line)	5,00%				-25 000	-25 000	-25 000	-25 000	-25 000	
Book value		100 000	300 000	500 000	475 000	450 000	425 000	400 000	375 000	0
Investments		-600 000	-700 000	-700 000	0	0	0	0	0	
Realizations		0	0	0	0	0	0	0	0	1 125 000
Depreciation		0	0	0	-175 000	-175 000	-175 000	-175 000	-175 000	
Realization profit (+) / loss (-)		0	0	0	0	0	0	0	0	-275 000
Book value		600 000	1 300 000	2 000 000	1 825 000	1 650 000	1 475 000	1 300 000	1 125 000	

**Picture 1**, investments table in Invest for Excel. Hint: When changing Outline level from 3 to 4 the book values of each asset is shown. The yellow cells show the Asset Book Values at the end of the calculation period. Also the green cells show by default the Asset Book Values at the end of the period, but these values can (and should) be adjusted to market value. This is done simply by typing, replacing the formula in the green cells. Notice that changing the residual value will give Realization profit/ loss, which will be included in the Income Statement.

The size of the *Residual Value* is of course very much depending of the term of calculation. In theory you should make the calculation term the same as the *Economic Life* of the main investment object.

The *Economic Life* being the expected period of time during which an asset is useful to the average owner. The *Economic Life* of an asset could be different than the actual physical life of the asset.

In reality the calculation term is often shorter than the *Economic Life*. This can be due to practical reasons, e.g. you have a better overview of 10 columns, than 40, or you do not want to make forecasts beyond 5 years, or the standard calculation period in your corporation's investment appraisals is set to be 10 years. Any of the above reasons increases the need for assessing the real *Residual Value*. Remember that the *Residual Value* also can be negative, e.g. demolition-, environmental cleaning- or restoration costs.

Different types of assets behave differently, technological equipment might lose value quite fast, whereas a residential building could increase in value. Please remember the time value of money when you enter the residual value. Example: if you assume a 2% annual value growth for a building over 10 years, use this formula to calculate the residual value:  $-\text{investment} * (1+2\%)^{10}$ .

## No Residual Value

Because of caution, or because of company guidelines you might not include any residual values. In Invest for Excel you have 3 optional ways **not** to include residual.

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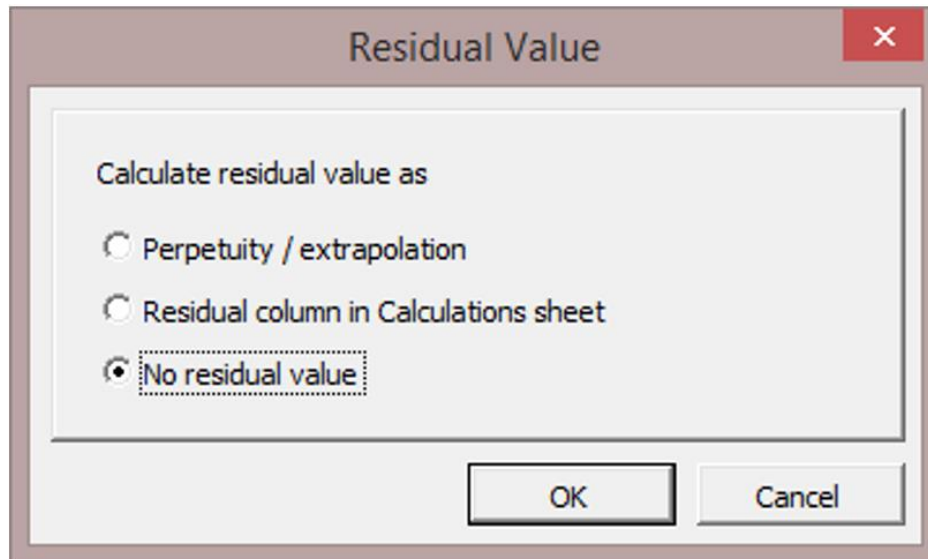
- Enter "0" for residual value in Residual column. This results potentially in a Realization loss in Income Statement but has no cash effects.
- Unselect the option "Automatically calculate realization value at the end of calculation term", which you can find in the "Depreciation method" dialog box. When this option is deselected there will be no realization at the end, and thus no profit/loss. The asset simply stays in the Balance sheet. See Picture:

The screenshot shows the 'Depreciation method' dialog box. The 'Asset' field is set to 'Building'. The 'Depreciation %' is 5 and the 'Depreciation time, years' is 20. The 'Depreciation method' list includes 'Straight line', 'Declining balance', 'One-time depreciation', 'Declining -> straight line', 'Sum-of-years ` digits', and 'Enter manually'. The 'Begin depreciation' dropdown is set to '12/2015 (months: 12)'. The 'First depreciation year includes No. of months' is 12, and the 'Use consecutively' checkbox is unchecked. The 'Balance Sheet Items' list includes 'Goodwill', 'Other intangible assets', 'Machinery and equipment', and 'Buildings and structures'. A blue arrow points to the 'Residual value' section, which has an unchecked checkbox for 'Automatically calculate realization value at end of calculation term'.

- Select "No residual value" option in the "Residual value" dialog box. This dialog box is available in the "Calculation term" dialog box accessed from "Basic Values" screen and in "Profitability analysis" screen on "Result" sheet. Note! **This function is available only in the Enterprise version.** When this option is selected there is no residual column at all in the calculation. See Picture:



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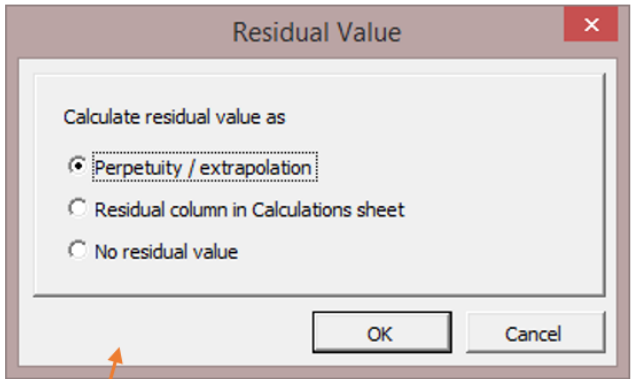
### Extrapolation

The *Extrapolation* function extends the cash flows beyond the original scope. Example: You are modelling an object with 40 year Economic Life with a stable income stream, e.g. a power grid. Instead of modelling 40 years, you could model the 10 first years and then extrapolate the next 30 years, assuming some steady development. **This function is available only in the Enterprise edition of Invest for Excel.** This is how you do it:

In the Residual Value dialog box, select Perpetuity / extrapolation:



# Invest for Excel®



PROFITABILITY ANALYSIS				
Project description	Production line			€
Nominal value of all investments	2 000 000	Discounted investments		1 950 942
Required rate of return	10,00 %			
Calculation term	10,5 years		7/2014 - 12/2024	
Calculation point	7/2014		(In the beginning of period)	
<u>Present value of business cash flows</u>		<u>Notes</u>		
± PV of operative cash flow	2 405 746			
<b>2</b> <span style="border: 1px solid blue; padding: 2px;">E</span> PV of residual value	<b>1</b> <span style="border: 1px solid blue; padding: 2px;">...</span> 1 882 474			
<b>Present value of business cash flows</b>	<b>4 288 220</b>			
- Present value of reinvestments (maintenance etc.)	0			
<b>Total Present Value (PV)</b>	<b>4 288 220</b>			

Then press 2<sup>nd</sup> button at left to open the settings for calculation of *Continuing Value* (PV of residual value).  
See picture:

PROFITABILITY ANALYSIS				
Project description	Production line			€
Nominal value of all investments	2 000 000	Discounted investments		1 950 942
Required rate of return	10,00 %			
Calculation term	10,5 years		7/2014 - 12/2024	
Calculation point	7/2014		(In the beginning of period)	
<u>Present value of business cash flows</u>		<u>Notes</u>		
± PV of operative cash flow	2 405 746			
<b>2</b> <span style="border: 1px solid blue; padding: 2px;">E</span> PV of residual value	<span style="border: 1px solid blue; padding: 2px;">...</span> 2 151 003			
<u>Extrapolation is based on</u>				
<input checked="" type="radio"/> Net cash flow for year	<b>1</b> 12/2024 <span style="border: 1px solid gray; padding: 2px;">▼</span> 512 097	Extrapolation period	<b>2</b> 30 years <span style="border: 1px solid gray; padding: 2px;">▼</span>	
<input type="radio"/> Enter annual value (€)		Base value (12/2024)	512 097	
<u>Type of extrapolation</u>				
<input type="radio"/> Standard (no growth)		Discount rate	8,00 %	
<input checked="" type="radio"/> Growing by annual percent	<b>3</b> 2,00	Value (12/2024)	5 851 460	
		Present value (7/2014)	2 151 003	
Implied Exit multiple	9,22	< Residual value	5 851 460	
<b>Present value of business cash flows</b>	<b>4 556 749</b>			

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- 1) Select year or enter cash flow to base the extrapolation on
- 2) To the right change from Extrapolation period "Perpetual" to "30 years"
- 3) Choose between no growth or choose "Growing by percent". The growth percent can also be negative.

## Going Concern

*Going Concern* means assuming that a business entity will continue to operate in the foreseeable future without the need or intention on the part of management to liquidate the entity or to significantly curtail its operational activities. In other words, we assume that the business will continue indefinitely.

In Invest for Excel® we use the term *Perpetuity*. A perpetuity is a stream of cash payments that continues forever. **The Perpetuity function is available only in the Enterprise edition of Invest for Excel®.**

*Perpetuity* is used when valuating companies and business operations and very often for real estate valuations as well.

Example:

Present value of business cash flows		Notes
± PV of operative cash flow	2 405 746	
<input checked="" type="checkbox"/> PV of residual value	2 400 155	
<b>Perpetuity is based on</b>		
<input type="radio"/> Net cash flow for year	12/2024 512 097	Extrapolation period <input type="radio"/> Perpetual
<input checked="" type="radio"/> Enter annual value (€)	522 339	Base value (12/2024) 522 339
<b>Type of perpetuity</b>		Discount rate 8,00 %
<input type="radio"/> Standard (no growth)		Value (12/2024) 6 529 237
<input checked="" type="radio"/> Growing by annual percent	2,00	Present value (7/2014) 2 400 155
Implied Exit multiple	10,29	< Residual value 6 529 237
<b>Present value of business cash flows</b>	<b>4 805 901</b>	

**Hint:** You may base the Perpetuity on an 11<sup>th</sup> year by choosing "Enter annual value", then entering a formula that multiplies the 10<sup>th</sup> year's Net cash flow with 1+growth% (see above).

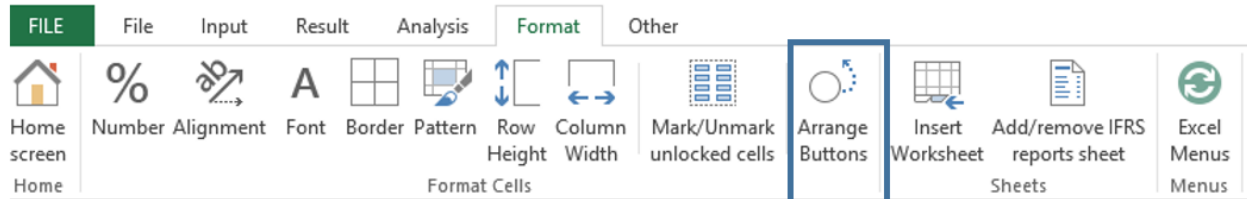
**Hint:** The "Implied Exit multiple" tells you how many last year's EBITDAs, the Value (12/2024) equals. E.g. Implied Exit multiple 10 tells us that the Residual Value equals 10 year's EBITDA.

**Hint:** Some Microsoft Excel versions cause a problem, when the buttons lose their places. It could look like this:

## Invest for Excel®

Present value of business cash flows		Notes
± PV of operative cash flow	1 757	
<input checked="" type="checkbox"/> PV of Terminal Value	1 359	
<input checked="" type="radio"/> Extrapolation is based on 1/2028		15 years
Net cash flow for year	232	Extrapolation period
Enter annual value (1 000 £)	194	Base value (1/2028)
<input type="radio"/> Type of extrapolation		Discount rate
Standard (no growth)		2,93 %
Growing by annual percent	2,00	Value (1/2028)
		2 797
Implied Exit multiple	9,28	Present value (2/2013)
		1 359
		< Residual value
		2 797
<b>Present value of business cash flows</b>	<b>3 116</b>	
- Present value of REFIT / future investment	-136	VALUE OF REFIT INPUT £200K
<b>Total Present Value (PV)</b>	<b>2 980</b>	

The fix is to run the "Arrange buttons" function found in the "Format" menu of Invest for Excel:



The Arrange buttons function puts the workbook's all buttons back in place!

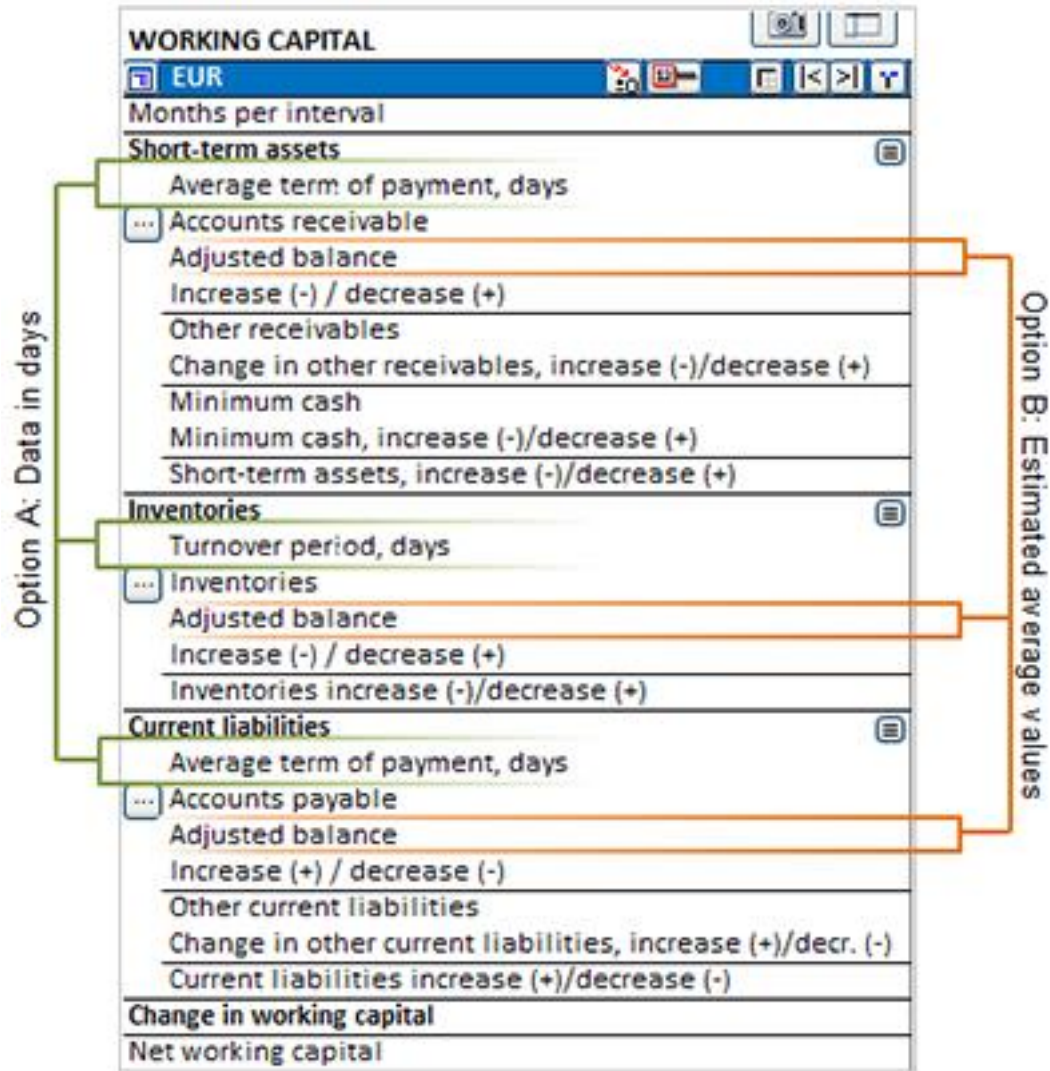
## 7. Treatment of working capital

Invest for Excel® provides a structured approach to the treatment of Working capital.

There are three main Working capital groups: Short-term assets, Inventories and Current liabilities (see Picture 1)

By defining each of these components, you receive a more accurate estimation of your project or business. It only takes a few minutes to define each sub-group by entering required data in **days** (Option A) or by entering the estimated average values in the **Adjusted balance** rows (Option B) (see Picture 1).

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Picture 1. Working capital.

## Option A. Entering data in days

**Note:** If the Average term of payment for accounts receivable / accounts payable / turnover period is longer than the number of days per column (e.g. 45 days in a monthly calculation) the balance will be increased by only 30 days of costs (not 45), however, the next period or periods will be affected cumulatively.

### Step 1. Defining Short-term assets

How much short-term assets an investment project or business ties up depends mainly on Accounts receivable.

Enter the Average term of payment for accounts receivable in days (i.e., the average number of days from

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delivery until payment) and the program will calculate the average amount of accounts receivable per interval based on sales (Income row in Income statement) and rotation. The following formula is used:

$$\text{Accounts receivable} = \text{Term of payment, days} * \frac{\text{Sum of selected rows for the current period}}{\text{Number of days in period}}$$

Invest for Excel® also allows defining **Other receivables** and **Minimum cash** reserves (see Picture 3).

The total of short-term assets is calculated by program according to the following formula:

$$\begin{array}{l} \text{Short-term assets} \\ \text{increase(-)/} \\ \text{decrease(+)} \end{array} = \begin{array}{l} \text{Change in} \\ \text{accounts} \\ \text{receivable} \end{array} + \begin{array}{l} \text{Change in} \\ \text{other} \\ \text{receivables} \end{array} + \begin{array}{l} \text{Minimum cash} \\ \text{increase (-) /} \\ \text{decrease (+)} \end{array}$$

### Step 2. Defining Inventories

Inventories tie up capital and have an impact on the investment's profitability. Inventories comprise:

- Raw materials and consumables (materials and supplies);
- Work in progress;
- Finished goods.

Enter Turnover period in days and the program will calculate the average amount of inventories per interval and rotation. The following formula is used:

$$\text{Inventory} = \text{Turnover period, days} * \frac{\text{Sum of amounts in the selected rows for the current period}}{\text{Number of days in period}}$$

The true residual value of the inventory can be entered into the last column if a value different from the one calculated by the application is preferred.

### Step 3. Defining Current liabilities

Defining current liabilities helps to better answer the question of how much less working capital is needed thanks to payment terms to suppliers.

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Enter the average term of payment for accounts payable in days (i.e., the average number of days from receiving the goods until payment). The program will calculate the average amount of accounts payable per interval, by default, based on the two first rows of Variable costs ("Raw materials and consumables" and "External charges") in the Income statement.

Invest for Excel® liquidates the accounts payable automatically at the end of the investment term in the last column, otherwise they would remain outstanding (unpaid). To overrule this feature, type in the preferred value in the row Adjusted balance in the "Residual" column.

Other than accounts payable there may be other current liabilities, e.g. advance payments from customers, tax liabilities, accrued expenses or prepaid revenues. This kind of items are not necessary required in all investment calculations.

Current liabilities are calculated according to the formula:

$$\text{Current liability} = \text{Term of payment, days} * \frac{\text{Sum of amounts in the selected rows for the current period}}{\text{Number of days in period}}$$

### Option B: Estimated average values

As it was mentioned before, there is an alternative way of defining short-term assets, inventories and short-term liabilities: entering the estimated average values in the **Adjusted balance** rows (see Picture 3). The values in the "**Adjusted balance**" rows overrule the values entered in **days** (by Option A).

### Result

The last row of the table, **Net working capital**, shows the netted working capital tied up in the project or business. The larger the inventories are, the more capital they tie up. The longer the payment term given to customers, the more capital is out of the cash reserves. The terms of payment concerning accounts payable work in an opposite way.

$$\begin{array}{l} \text{Change in} \\ \text{working} \\ \text{capital} \end{array} = \begin{array}{l} \text{Short-term assets} \\ \text{increase(-)/} \\ \text{decrease(+)} \end{array} + \begin{array}{l} \text{Inventories} \\ \text{increase(-)/} \\ \text{decrease(+)} \end{array} + \begin{array}{l} \text{Current liabilities} \\ \text{increase(-)/} \\ \text{decrease(+)} \end{array}$$

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$$\text{Net working capital} = \text{Working capital (t-1)} - \text{Change in working capital (t)}$$

### 8. Using own Excel sheets with Invest for Excel®

Quite often users of Invest for Excel want to include own previously built Excel spreadsheets into the calculation file in order to link data or for explanatory purposes. Let's take a look how it can be done.

**Step 1.** Make sure that your calculation file and source MS Excel workbook are opened.



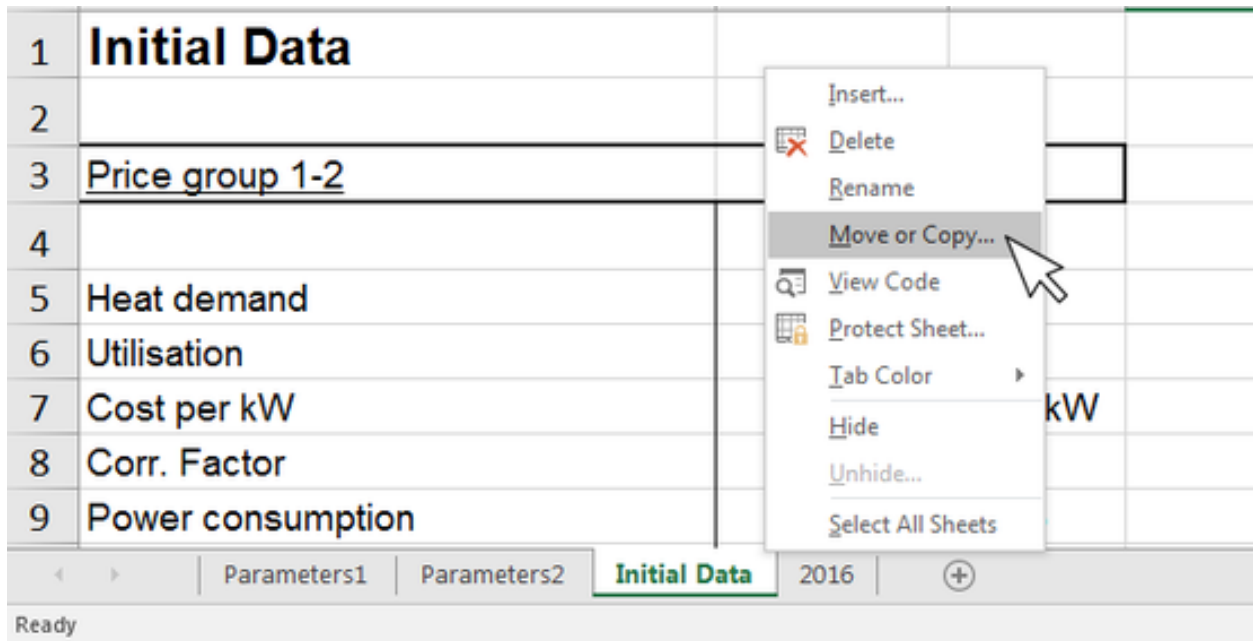
Invest for Excel Calculation file



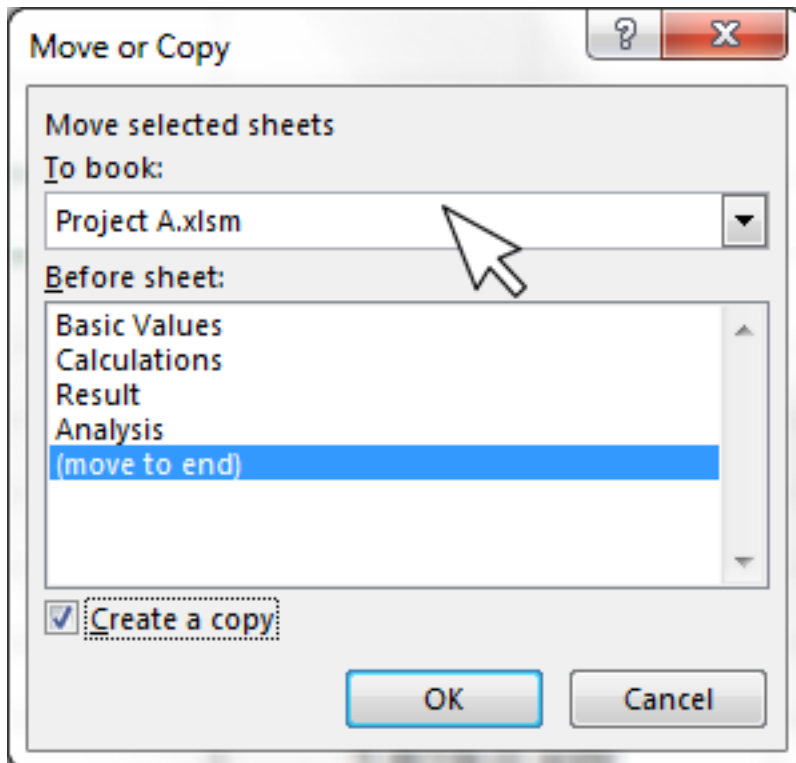
MS Excel Workbook

**Step 2.** Right-click on the tab for the worksheet you want to copy and select "Move or Copy" from the popup menu.

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Excel opens the "Move or Copy" dialog box.



**Step 3.** In the "To Book" drop-down list box, select your Invest for Excel calculation file that you want to copy the worksheet to.

In the "Before Sheet" list box, define place for copied worksheet. If you want the sheet that you're copying



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to appear at the end of the workbook, choose the "(move to end)" option.  
Select "Create a copy" check box and press OK.

**Step 4.** Notice that copied spreadsheet appeared in your Invest for Excel calculation file. Now you can build your calculation and link data.

The screenshot shows the Invest for Excel software interface. The formula bar at the top displays the formula `=Initial Data!B25/1000`. Below the formula bar is a toolbar with various icons. The main area displays an "INCOME STATEMENT" table with columns for "1/2016", "12/2016", "12/2017", and "12/2018". The table includes rows for "Months per interval", "Income specified:", "Connection fee", "Energy fee", "Impact fee", "Flowcharge", and "Income". The "Income" row shows values of 0, 3 140, 2 552, and 2 603. The "Initial Data" tab is selected at the bottom.

	1/2016	12/2016	12/2017	12/2018
Months per interval		12	12	12
Income specified:				
Connection fee		3 140		
Energy fee			1 809	1 845
Impact fee			538	549
Flowcharge			205	209
Income	0	3 140	2 552	2 603

In our example above we copied a spreadsheet called "Initial Data" from Excel workbook and inserted it to our Invest for Excel calculation file. Notice that in the formula bar we refer to data which is on recently copied spreadsheet.

*Hint 1:* If you need to insert several spreadsheets use the "Ctrl" key to select more than one spreadsheet.

*Hint 2:* More direct approach: you can also copy the spreadsheet(s) from Excel workbook just by dragging it to Invest for Excel file (hold down "Ctrl" key as you drag sheet tab).

### 9. “Goal – Seek” – a function everyone involved in financial modeling must know

(Short summary): Set the desired result for the formula and find the possible input variable necessary to achieve that result. Sounds good, isn't it? (Read)

In this article, we will take a look at a very useful Excel feature - Goal Seek function. It can bring great value for those involved in financial modeling and analysis, yet many people are not aware of it.

The Goal Seek function is part of Excel's What-If analysis toolset. Theoretically, it answers the question: what input variable you should have in order to reach the desired result. Practically, it adjusts one cell, to achieve a fixed desired result in another cell.

Let's take a look at one of the most common usage scenarios: Say, we have a complex forecasting model with many interlinked variables. We are curious to know what the selling price should be so that our project achieves 60% IRR.

For that we need to do the following:

1. Go to Excel menu > Data > What-If Analysis > Goal Seek

2. Define fields in popped-up window:

- "Set Cell": set the cell with the formula you want to resolve (IRR).
- "To Value": set the desired value you want the formula to return (60 %).
- "By changing cell": set the cell with variable to be changed (selling price).

3. Press OK. As a result, we can see that our project IRR will reach 60%, when the selling price is 403,64 EUR.

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Project description		Alpha Machine 37		Euro	
Nominal value of all investments	2,835,000	Discounted investments	2,813,329		
Required rate of return	2.75 %				
Calculation term	5.3 years		9/2017 - 12/2022		
Calculation point	9/2017		(In the beginning of period)		
Present value of business cash flows		Nominal	PV	Notes	
± PV of operative cash flow			11,335,858		
+ PV of residual value			3,821,870		
<b>Present value of business cash flows</b>			<b>15,157,727</b>		
- Present value of reinvestments		0	0		
<b>Total Present Value (PV)</b>			<b>15,157,727</b>		
<u>Investment proposal</u>		Nominal	PV		
- Proposed investments in assets		-2,835,000	-2,813,329		
+ Investment subventions		0	0		
Investment proposal		-2,835,000	-2,813,329		
<b>Net Present Value (NPV)</b>			<b>12,344,398</b>	>= 0	-> profitable
NPV as a monthly annuity			207,406		
Internal Rate of Return (IRR)		50.27%	>= 2.75 %	->	profitable
Modified Internal Rate of Return (MIRR)		34.11%	>= 2.75 %	->	profitable
Profitability Index (PI)		5.39	>= 1	->	profitable
Payback time, years		2.8	Based on discounted FCF		
Return on net assets (RONA), %		76.2 %	Average 6 years		
Economic Value Added (EVA)		2,444,821	Average 6 years		
Discounted Value Added (DCVA)			12,235,665		
Calculation is made by		Datapartner Customer Support		25-05-16	
Calculation file					

In a similar way, Goal Seek function can be applied to almost any parameter of your model. It is commonly used for analysing following profitability indicators: NPV, IRR, MIRR, RONA, Profitability Index, Payback time and others.

**Note:** When using Goal Seek function remember that "by changing cell" field must not include a formula!

Let's take a look at another calculation scenario. Say, that we want to know what the selling price should be so that Net Income in each period equals 0.

For that we need to do the following:

1. Go to Excel menu > Data > What-If Analysis > Goal Seek
2. Define fields in popped up window:

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- "Set Cell": set the cell with the formula you want to resolve (Net Income for the period).
- "To Value": set the desired value you want the formula to return (0).
- "By changing cell": set the cell with variable to be changed (selling price).

3. Press OK. As a result, we can see that Net Income for the period will equal 0, when the selling price is 210.76 EUR.

4. Repeat the same steps for the following periods.

Euro		12/2018	12/2019	12/2020
Months per interval		12	12	12
Income specified:				
Sales		10,748,708	13,167,167	16,129,779
+	Capacity / month	108,000	108,000	108,000
*	Utilization rate	39.7 %	49.6 %	62.0 %
*	Price / meter	251.00	245.98	241.06
<b>Income</b>		<b>10,748,708</b>	<b>13,167,167</b>	<b>16,129,779</b>
Raw materials and consumables		-7,524,095	-9,217,017	-11,290,846
+	Other variable costs	-7,524,095	-9,217,017	-11,290,846
	Variable cost-%	70.0 %	70.0 %	70.0 %
<b>Gross margin</b>		<b>3,224,612</b>	<b>3,950,150</b>	<b>4,838,934</b>
Other fixed costs		-2,400,000	-2,400,000	-2,400,000
<b>EBITDA; Operating income before depreciation</b>		<b>824,612</b>	<b>1,550,150</b>	<b>2,438,934</b>
Depreciation		-307,583	-270,188	-225,266
<b>EBIT; Operating income</b>		<b>517,029</b>	<b>1,279,963</b>	<b>2,213,668</b>
Financing income and expenses		0	0	0
Financing income and expenses				
Financing income and expenses, Financing file				
<b>EBT; Income after financing items</b>		<b>517,029</b>	<b>1,279,963</b>	<b>2,213,668</b>
Extraordinary income and charges		0	0	0
Realization profit (-loss)		0	0	0
Other extraordinary income (-charges )				
<b>Income before appropriations and taxes</b>		<b>517,029</b>	<b>1,279,963</b>	<b>2,213,668</b>
Change in Appropriations				
Appropriations, increase (-) / decrease (+)				
Income tax		-144,768	-358,390	-619,827
Deferred tax				
Minority interest				
<b>Net income for the period</b>		<b>372,261</b>	<b>921,573</b>	<b>1,593,841</b>
Return on net assets (RONA), %		13.3%	34.9%	58.5%

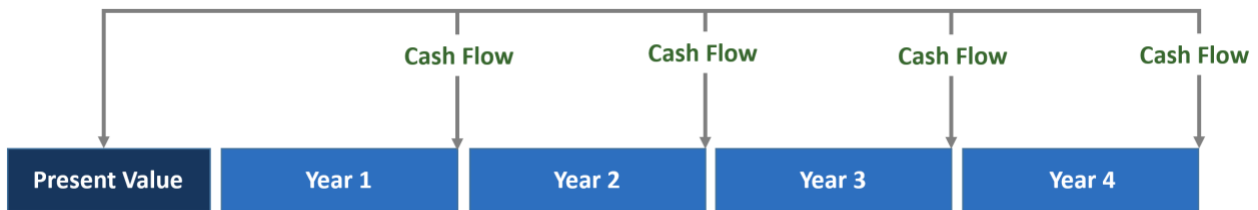
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Calculation displayed above is quite common for nonprofit organizations, when it is necessary to avoid making a profit - by keeping prices for products or services at just enough level to cover the operating costs.

## 10. Mid-year discounting vs End-of-year discounting

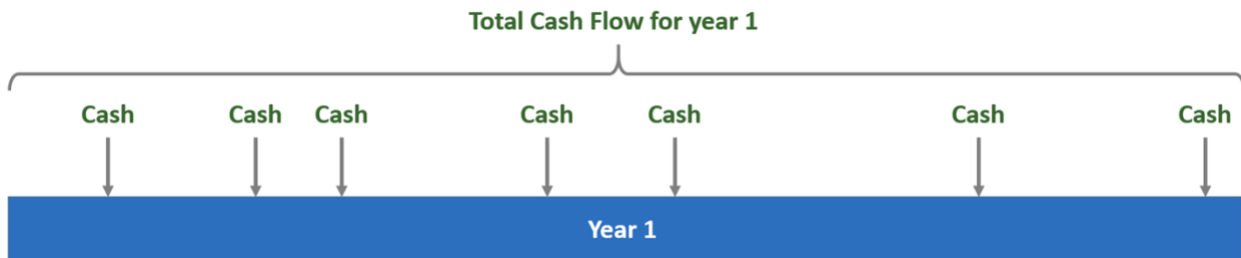
When we use standard **End-of-year discounting**, theoretically, we assume that the entire value of cash flow for a given year comes in at the very end of that year:

Picture 1. End-of-year discounting



However, in reality, a business may generate a smooth income stream throughout the year:

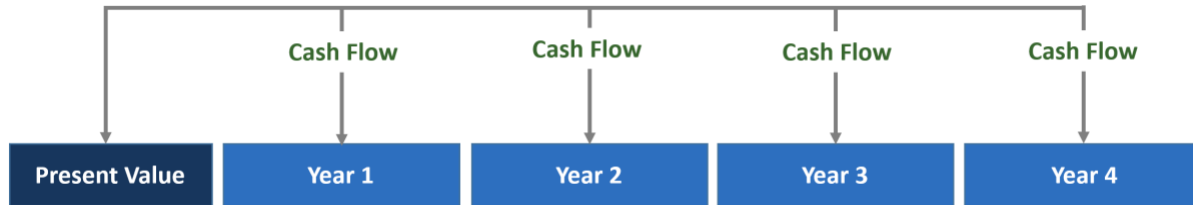
Picture 2. Actual cash transactions



To provide more accurate figures we can use **Mid-year discounting**. With Mid-year discounting we discount the cash flows as if they occurred in the middle of the year. Thus, cash flow for year 1 will be discounted over a period of 0.5, cash flow for year 2 over a period of 1.5 and etc:

Picture 3. Mid-year discounting

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When your calculation is created on yearly basis you can use Mid-year discounting. Note that Mid-year discounting should not be applied when shorter periods (less than 12 months) are used!

### To turn on mid-year discounting in Invest for Excel:

- Open the "Discount Rate" dialog box from the "Basic Values" screen of the calculation file
- Check "Mid-year discounting" in the dialog box

BASIC VALUES						
Project description	Investment project 1					
Calculation term, years	...	10 years				
Interval length, months		12				
Number of intervals		10				
		(MM/YYYY)				
Calculation term begins		01/2017	(in the beginning of period)			
Calculation point		01/2017	(in the beginning of period)			
Calculation term ends		12/2026	(in the end of the period)			
Figures (1/1000/1000000)		1				
Currency	<>	€				
Discount rate (per annum)	...	8.00 % (required rate of return)				
Income tax %		2017	2018	2019	2020	2021 ->
			0	0	0	0

When you use Mid-year discounting, the corresponding notes appear in "Basic values" and "Profitability analysis" screens.

Zero-period and Residual value are unaffected and are calculated the same way in mid-year discounting and end-of-year discounting.

Extrapolated residual value is calculated as end-of-year cash flows in both mid-year discounting and end-of-year discounting.

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## Example: Mid-Year discounting vs End-year discounting

Now let's compare resulting NPV by applying these 2 different discounting methods (discount rate is 8%)

Option A. Mid-year discounting:

CASH FLOW STATEMENT						
	1/2017	12/2017	12/2018	12/2019	12/2020	12/2021
Months per interval		12	12	12	12	12
Income	0	600,000	600,000	600,000	600,000	600,000
<b>Cash flow from operations</b>	<b>0</b>	<b>380,000</b>	<b>380,000</b>	<b>380,000</b>	<b>380,000</b>	<b>380,000</b>
Asset investments and realizations	-3,000,000	-500,000	0	0	0	0
<b>Free cash flow (FCF)</b>	<b>-3,000,000</b>	<b>-120,000</b>	<b>380,000</b>	<b>380,000</b>	<b>380,000</b>	<b>380,000</b>
<b>Discounted free cash flow (DFCF)</b>	<b>-3,000,000</b>	<b>-115,470</b>	<b>338,570</b>	<b>313,490</b>	<b>290,269</b>	<b>268,767</b>
Cumulative discounted free cash flow	-3,000,000	-3,115,470	-2,776,900	-2,463,410	-2,173,141	-1,904,374

Net Present Value (NPV) = 789 914 (€)

Option B. End-year discounting:

CASH FLOW STATEMENT						
	1/2017	12/2017	12/2018	12/2019	12/2020	12/2021
Months per interval		12	12	12	12	12
Income	0	600,000	600,000	600,000	600,000	600,000
<b>Cash flow from operations</b>	<b>0</b>	<b>380,000</b>	<b>380,000</b>	<b>380,000</b>	<b>380,000</b>	<b>380,000</b>
Asset investments and realizations	-3,000,000	-500,000	0	0	0	0
<b>Free cash flow (FCF)</b>	<b>-3,000,000</b>	<b>-120,000</b>	<b>380,000</b>	<b>380,000</b>	<b>380,000</b>	<b>380,000</b>
<b>Discounted free cash flow (DFCF)</b>	<b>-3,000,000</b>	<b>-111,111</b>	<b>325,789</b>	<b>301,656</b>	<b>279,311</b>	<b>258,622</b>
Cumulative discounted free cash flow	-3,000,000	-3,111,111	-2,785,322	-2,483,666	-2,204,355	-1,945,733

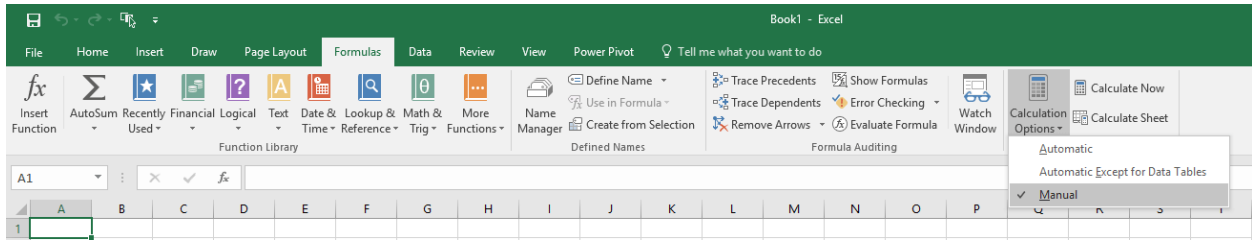
Net Present Value (NPV) = 708 045 (€)

## 11. Automatic calculation vs Manual calculation

Have you ever noticed that the larger an Excel file gets, the slower the calculation? In some cases, if you are working with a complex file which contains a very large number of formulas and data, it can take a long time to recalculate. Why? Roughly speaking, after each change in your Excel workbook, Excel automatically recalculates all cells that are affected by this change.

Good news is that Excel has a range of options allowing you to control the way it calculates, that can help you to save time. To avoid recalculating every time you change anything, go to "Formulas", "Calculation Options" and choose "Manual":

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Now, your workbook will be recalculated whenever you save it or press a shortcut like F9. See the complete list of keyboard shortcuts below.

To	Press
Recalculate formulas that have changed since the last calculation and formulas dependent on them in all open workbooks.	<b>F9</b>
Recalculate formulas that have changed since the last calculation and formulas dependent on them in the active worksheet.	<b>SHIFT+F9</b>
Recalculate all formulas in all open workbooks, regardless of whether they have changed since the last recalculation.	<b>CTRL+ALT+F9</b>
Recheck dependent formulas, and then recalculate all formulas in all open workbooks, regardless of whether they have changed since the last recalculation.	<b>CTRL+SHIFT+ALT+F9</b>

Manual calculation option is also fully compatible with [Invest for Excel®](#) calculation models.