

CHAPTER 8

Smart *Excel* Appendix

Appendix Contents

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Use the Smart *Excel* spreadsheets and animated tutorials at the Smart Finance section of <http://www.cengage.co.uk/megginson>.

EXCEL PREREQUISITES

You need to be familiar with the following *Excel* features to use this appendix:

- Creating a cumulative formula
- Use of the average function

This material was covered in Chapters 5 and 6 but is repeated on the *Excel Prereqs* tab of the Chapter 8 *Excel* file located at the *Smart Finance Web site*.

CAPITAL BUDGETING TECHNIQUES

Problem: Evaluate the capital budgeting decision faced by WireVid! as described in Chapter 8.

WireVid! is contemplating a major expansion of its wireless network in two different regions. By investing €250 million, it can add up to 100 new cell sites to its existing base in Western Europe. By investing €50 million, it can enter a new market in the Southeast United States. Company analysts project the following year-end net after-tax cash flows. The firm uses an 18 percent discount rate.

	Western Europe Project (in €millions)	Southeast U.S. Project (in €millions)
Initial outlay	-€250	-€50
Year 1 cash flow	€35	€18
Year 2 cash flow	€80	€22
Year 3 cash flow	€130	€25
Year 4 cash flow	€160	€30
Year 5 cash flow	€175	€32

ACCOUNTING RATE OF RETURN

Approach: Find the project net income and divide by the book value of assets.

To find the accounting rate of return, follow these steps:

1. Fill in the input assumption on project cash flows and the depreciable life of the assets. In this example, both projects are assumed to have a 5-year straight-line depreciation.
2. Find the annual depreciation for each project. Here, this is equal to the initial investment divided by the depreciable life. (Remember to use absolute references, as needed.)

3. Create a formula to calculate the annual project net income. In the WireVid!example, this is assumed to be project cash flow minus depreciation. Then, use the average function to find average annual income over the project life.
4. Create a formula to find the asset book value. Each year this is the starting value less depreciation. Then, use the average function to find the average asset book value.
5. The accounting rate of return is the average income divided by the average book value.

Your results should match:

Calculations

	<i>Year</i>	0	1	2	3	4	5
<i>Western Europe Project</i>							
Depreciation				(50)	(50)	(50)	(50)
Net income				(15)	30	80	110
Average net income			66				
Asset book value		250	200	150	100	50	0
Average book value			125				
<i>Southeast U.S. Project</i>							
Depreciation				(10)	(10)	(10)	(10)
Net income				8	12	15	20
Average net income			15				
Asset book value		50	40	30	20	10	0
Average book value			25				

Output

<i>Accounting ROR Western Europe Project</i>	52.8%
<i>Accounting ROR Southeast U.S. Project</i>	61.6%

PAYBACK

Approach: Find the cumulative cash flows from the project.

Open the Chapter 8 Excel file located at the Smart Finance Web site. Open the *Payback* tab.

Enter the input information. Begin years with 0. Enter the cash flow assumptions for each project.

To find the project payback, follow these steps:

1. Create a formula to calculate the cumulative cash flow in each year. In year 0 (set up), this is the initial investment. In year 1, it is the initial investment plus the cash flows in year 1. Try to set up one formula that can be accurately copied across all years and copied down for the second project’s cumulative cash flows. See the *Excel Prereqs* tab for help.
2. The year in which the initial investment is recovered is the payback year.

Apply it

- **Which project has a more favorable payback?**
The Southeast U.S. project has a faster payback.

Your results should be:

	<i>Year</i>	0	1	2	3	4	5
<i>Cumulative cash flow – Western Europe</i>				35	115	245	405
<i>Cumulative cash flow – Southeast United States</i>			18	40	65	95	127

Payback occurs when the initial investment is recovered. Because the initial investment for the Western Europe project is €250 million, payback is in the fourth year. The initial investment for the U.S. project is €50 million so payback is in the third year.

DISCOUNTED PAYBACK

Approach: Find the present value of the project cash flows and then find the cumulative cash flows using the discounted cash flows.

To find the discounted project payback, follow these steps:

1. Create a formula to calculate the present value of each year's cash flows. Copy across for all years.
2. Create a single formula to find the cumulative cash flow, based on the discounted cash flows.
3. The year in which the initial investment is recovered is the payback year.

Your results should be:

	Year	0	1	2	3	4	5	
PV of cash flows – Western Europe				30	57	79	83	76
PV of cash flow – Southeast								
United States			15	16	15	15	14	
Cum disc cash flow – Western Europe			30	87	166	249	325	
Cum disc cash flow – Southeast								
United States			15	31	46	62	76	

NET PRESENT VALUE

Approach: Use the NPV function.

To find the project net present values, use the npv function in *Excel*. The format is:

$$=CF_0 + npv(\text{rate}, CF_1, CF_2, \dots, CF_n) \text{ or}$$

$$=CF_0 + npv(\text{rate}, CF_1:CF_n)$$

where the rate is the discount rate, CF_0 is the initial investment, CF_1 is the cash flow in year 1, and CF_n is the cash flow in the final year.

Important: When using the NPV function, DO NOT include the year 0 cash flow within the function because it will then get discounted. The NPV function discounts the first cash flow for one year, the second for two years, etc.

The formula to find the net present value of the Western Europe project is:

$$= \text{initial investment} + NPV(\text{rate}, CF_1:CF_5)$$

$$=D16 + npv(D18, E16:I16)$$

$$=€75.3 \text{ million.}$$

The net present value of the Southeast U.S. project is €25.7 million.

Apply it

Sum the present values for the cash flows from year 0 through year 5 for the Western Europe project. What is your result?

The result is €75.3 million, the project net present value. You can find the NPV by either using the NPV function or discounting the cash flows and summing the present values. This alternative calculation is shown in the file solution.

Analyze the impact of the discount rate on the decision faced by WireVid!

- **Suppose the discount rate is 15%?**
- **Suppose the discount rate is 21%?**

The net present values are:

NPV with discount rate of:	15%	21%
Western Europe project	€104.8 million	€49.1 million
Southeast U.S. project	€31.8 million	€20.3 million

At a lower discount rate, both projects look more attractive. At higher discount rates, the present value of the cash inflows falls.

INTERNAL RATE OF RETURN

Approach: Use the *IRR* function.

To find the project net present values, use the *irr* function in *Excel*. The format is:

=irr(CF0,CF1,CF2,...CFn) or
=irr(CF0:CFn)

where CF0 is the initial investment, CF1 is the cash flow in year 1, and CFn is the cash flow in the final year.

Important: When using the IRR function, DO include the year 0 cash flow within the function.

The formula to find the net present value of the Western Europe project is:

= irr(CF0:CF5)
=irr(D16:I16)
=27.8%

The internal rate of return of the Southeast U.S. project is 36.7%.

Apply it

Analyze the impact of the discount rate on the decision faced by WireVid!

- *Suppose the discount rate is 15%?*
- *Suppose the discount rate is 21%?*

Changing the discount rate has no effect on the internal rate of return since the discount rate is not part of the internal rate of return calculation. The internal rate of return is the rate that leads to a net present value of zero.

PROFITABILITY INDEX

Approach: Compare the ratio of the present value of the project's cash flows (excluding the initial investment) with the initial investment.

To find the profitability index, sum the cash flows from the project from year 1 on, divide this sum by the initial investment. This ratio will be a negative number if the initial investment is negative. Change the sign to a positive number by beginning the formula with a negative sign.

= – (sum of the present value of cash flows from year 1 through project end)/initial investment
= – sum(E22:I22)/D22
=1.30

For Southeast U.S., the profitability index equals 1.51.

Apply it

Analyze the impact of the discount rate on the decision faced by WireVid!

- *Suppose the discount rate is 15%?*
- *Suppose the discount rate is 21%?*

The profitability index is:

PI with discount rate of:	15%	21%
Western Europe project	1.42	1.20
Southeast U.S. project	1.64	1.41

SOLVE PROBLEM 8-21

Solve Problem 8-21

Find the project net present value, the internal rate of return, and the profitability index. Our solution is provided on the final two tabs in the *Excel* file.

Now follow these steps to create the *NPV* profile.

To create a net present value profile, follow these steps:

1. Begin with the solution.
2. Create a table with the project *NPVs* at different discount rates. To create the table, enter the various discount rates in the first column. Then, in the next column, create a formula for *NPV* that refers to the discount rate. Copy the formula down through the various discount rates and across for other projects. It should be set up like the table below, although in the file we continue through rates of 20 percent:

The discount rates are typed in (to save time, use the fill-series feature on the edit menu). The NPVs are the result of the formula.

3. Create a graph by selecting the two columns of *NPVs* and using the graph icon. Select a line graph.

The graph shows the net present-value profile of the two projects. You will have to add titles and reformat slightly to get your graph to look like our solution.

Discount Rate	NPV of Repackage	NPV of Reformulate
0%	1,250,000	8,500,000
1%	1,168,975	7,691,837
2%	1,090,801	6,916,136
3%	1,015,337	6,171,172
4%	942,453	5,455,327
5%	872,025	4,767,090

Apply it

- *What does the NPV profile indicate?*

The *NPV* profile shows the project *NPVs* at different discount rates. Note that at very low discount rates, the *NPV* of the reformulate project is much higher than the *NPV* of the repackage project.