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How to calculate the discounted payback period in excel

The payback period is the time it takes for a project to recover the investment cost. For example, if you invest \$100 and the returns are \$50 per year, you will recover your initial investment in two years. The payback period is a simple and quick way to assess the convenience of an investment project and to compare different projects. For example, if project A has a payback period of three years, while project B has a payback period of four years, you will choose project A. Can you notice an issue with the payback period? Think for a moment. OK, the payback period has two main issues: It doesn't take the time value of money into account. It doesn't take into account all the cash flows that happen after the accumulated cash flow is zero. Buy the Ready Excel Spreadsheet Now - Only \$5 The time value of money is an economic concept that refers to the fact that money available in a near future is worth more than the identical sum in the far future. The payback period can be seen as the time it takes a project, to reach an accumulated cash flow of zero. But two different projects can have the same payback period, while the first one has larger positive cash flows after the payback period. Clearly, the first one is preferable. Alternatives to the Payback Period Because of the issues with the payback period, the Internal Return Rate (IRR) and the Net Present Value (NPV) are better alternatives to the PP. These measurements do take the time value of money and all the cash flows into account. Examples of the Payback Period Same cash flow every year When the cash flow remains constant every year after the initial investment, the payback period can be calculated using the following formula: $PP = \text{Initial Investment} / \text{Cash Flow}$ For example, if you invested \$10,000 in a business that gives you \$2,000 per year, the payback period is $\$10,000 / \$2,000 = 5$ If you invested \$8,000 and the cash flow remains \$2,000 per year, the payback period reduces to 4 years: Another way to view the payback period is to check when the accumulated cash flow, including all the investments, equals zero. But sometimes this is not so easy, because there is a period of negative accumulated cash flow followed by a period with positive accumulated cash flow. There is no period with zero accumulated cash flow. In this case, what period do we take into account? The first one or the second one? When there is no period of zero accumulated cash flow, the payback period will be a positive rational number, not an integer. To calculate the payback, you must estimate the fraction of the year that passed since the cash flow was negative for the last time until it reached the zero value. For this estimation, we assume a linear behavior of the evolution of the cash flow. If the absolute value of the last negative accumulated cash flow is the same as the first accumulated positive one, the fraction is 0.5, like in the following example: In the following plot, we can see the evolution of the accumulated cash flow: When the absolute value of the last accumulated cash flow is not the same as the first positive cash flow, the fraction will not be 0.5: How to Calculate the Payback Period in Excel While it is possible to have a single formula to calculate the payback, it is better to split the formula into several partial formulas. This way, it is easier to audit the spreadsheet and fix issues. Follow these steps to calculate the payback in Excel: Enter all the investments required. Usually, only the initial investment. Enter all the cash flows. Calculate the Accumulated Cash Flow for each period For each period, calculate the fraction to reach the break even point. Use the formula "ABS" Count the number of years with negative accumulated cash flows. Use the formula "IF" Find the fraction needed, using the number of years with negative cash flow as index. Use the formula "INDEX" To get the exact payback period, sum the number of years with negative accumulated cash flow and the corresponding fraction Shameless plug: We created an Excel file to calculate the payback. It updates automatically and allows to enter multiple investments, not only an initial investment. It displays the payback using fraction years and also years months and days. Actually, we used this file to create our examples, you can get it for only \$5 using the following link: Buy the Ready Excel Spreadsheet Now - Only \$5 This page shows how you can compute the payback period in excel since there is no payback function. Of course there are problems with the payback period, but that does not mean it should not even be a function in excel. This page shows you how to make a payback function in excel with a User Defined Function (UDF). With the payback function UDF, you can simply enter a function on a series of cash flows and find the payback with percent of month or percent of year with =PAYBACK(cash flows). Technical details demonstrate how to create the UDF function with VBA code by accumulating cash flow and then computing the percent of the period once the accumulated cash flow changes from negative to positive. The payback function is heavily critiqued by business schools. This is snobbish as so many real world decisions are still made by assessing how many years an investment takes to payback. You can use Match and Index along with adding another line (or column) to find an integer that gives you an approximate payback. But there is no detailed payback function or discounted payback function in excel, which is amazing. The file below has a payback function. You can also just copy the code below into your excel file. Finally, there is a video that explains how to make a payback function. The file that contains the payback functions is available for download below. Excel File with User Defined Functions for Payback Period and Discounted Payback Period Using the Payback UDF Once you have created the payback UDF function, you can use the PAYBACK function and the DPAYBACK function as shown in the screenshot below. In the example, I have made a simple cash flow and you can demonstrate that if the cash flow after the outflow is 10, the payback period is 10 years. The example shows that you can click on the entire line to get the payback period. The discounted payback period counts how many period it takes to repay the cash flow when a discount rate is included for the cash flow. Inserting the Payback Function into a Your Workbook After you open the file that is available for download above you can do a few things to get the function into your sheet. One is to press the button that will produce a user form. Then, in the text that comes up, just select the VBA code and copy it to your sheet (as shown in the screenshot below the file). Alternatively, you can press the ALT and F8 key sequence, edit the VBA code, press CNTL, C and then copy it to your file. Once you have copied the VBA code (either from the userform, from pressing ALT, F8 and copying the entire sheet or from copying the code below), you can copy it into your file. To do this, you can press ALT, F8 to get the VBA screen. Then put in any name (e.g. Stormy). Then go to the top of the file and copy the code (CNTL, V). Some of this is demonstrated in the couple of screenshots below. The first screen shot illustrates how to create a new VBA page after you press ALT, F8; the second shows how you should insert a line to put the code at the top of the page; the third shows the results after you copy. After making the new page with you blank macro named Stormy, go above the new macro and enter a couple of blank lines. When you have entered the blank lines you will press the CNTL, V and copy the code to the top of the page. After you have copied the code into your sheet, you should see OPTION BASE 1 at the top of the page. Now you are ready to go and the function should work in your workbook. Creating the Payback Function and Discounted Payback Function The user defined functions for creating a payback and the discounted payback functions are presented below. You can see the adjustment required so that an entire row can be used and you can see how the loop works with counting the number of cash flows. . Function payback(series) Dim cum_series(1000), adj_series(1000) As Single ' dimesion of cumulative cash Count = 0 For i = 1 To 1000 ' Adjustment for entire row If WorksheetFunction.IsNumber(series(i)) = True Then ' Only include numbers in new array Count = Count + 1 adj_series(Count) = series(i) End If Next i tot_number = Count counter = 0 For i = 1 To tot_number ' loop around cash flows If (i = 1) Then cum_series(i) = adj_series(i) ' cumulative cash flow counter = counter + 1 ' count if the cash is positive If (i > 1) Then cum_series(i) = cum_series(i - 1) + adj_series(i) ' cumulative cash flow End If If (cum_series(i) > 0) Then ' test when turns to positive GoTo finished: End If Next i num = i finished: ' compute payback If (cum_series(i) - cum_series(i - 1) < 0) Then factor = -cum_series(i - 1) / (cum_series(i) - cum_series(i - 1)) ' Compute the factor to add to the payback for pct of yr Else factor = 0 End If If (i < series.Count) Then payback = factor + counter - 2 Else payback = num End If End Function . The function below is very similar, but it includes discounting the cash flow. This discounting can be adjusted if you do not want the initial outflow discounted (in this case you could raise the discount factor to the count minus 1). . Function dpayback(d_rate, series) Dim cum_series(1000), dfactor(1000) As Single ' dimesion of cumulative cash Count = 0 For i = 1 To 1000 ' Adjustment for entire row If WorksheetFunction.IsNumber(series(i)) = True Then ' Only include numbers in new array Count = Count + 1 adj_series(Count) = series(i) End If Next i tot_number = Count counter = 0 For i = 1 To tot_number ' loop around cash flows dfactor(i) = 1 / ((1 + d_rate) ^ counter) adj_series(i) = adj_series(i) * dfactor(i) If (i = 1) Then cum_series(i) = adj_series(i) ' cumulative cash flow counter = counter + 1 ' count if the cash is positive If (i > 1) Then cum_series(i) = cum_series(i - 1) + adj_series(i) ' cumulative cash flow End If If (cum_series(i) > 0) Then ' test when turns to positive GoTo finished: End If Next i i = num finished: ' compute payback If ((cum_series(i) - cum_series(i - 1) < 0) Then factor = -cum_series(i - 1) / (cum_series(i) - cum_series(i - 1)) ' Compute the factor to add to the payback for pct of yr Else factor = 0 End If If (i < series.Count) Then dpayback = factor + counter - 2 Else dpayback = num End If End Function . Video Describing How to Create Payback Functions If all of the above explanation does not do enough, then you can watch a video on how to create a payback function. how to find discounted payback period in excel. how to do discounted payback period in excel. how do you calculate discounted payback period in excel

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