



Introduction to Excel for Management
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TEACHING NOTE: CHALLENGE 4

In this fourth challenge we are going to make use of the Data Table tool (not to be confused with the Tables or Create Tables tools), which will allow us to perform sensitivity analysis with one or two variables and which will notably enrich the information provided by our projection model.

It is essential to start by understanding the difference between scenario generation, which we have just seen, and sensitivity analysis. We must also understand when is better to use one or another:

- The fundamental difference between both approaches is that in the first case (scenarios) we can modify as many variables as we want and observe how it affects our entire income statement.
- In the second case (sensitivity with Data Table) we can modify one or two variables and observe how it affects one, or a set of specific results.

In our case, and to serve as an example, we are going to see how different percentage values (from 1% to 8%) of the variable called "Sales Growth" affect the gross margin. Later we will see how different values of "Sales Growth" (from 6% to 9%) combined with different percentage values of the variable "Expenses Growth" (from 10% to 17%) affect gross profit for the fifth year. If we wanted to solve this task with the Scenarios tool, we would have to perform 8 scenarios for the first case and 24 for the second, which, obviously, would be extremely tedious and inefficient.

Creating the Tables

The first thing we will have to do is prepare the data entry of the tables that we are going to use:

	K	L	M	N	O	P
2			[Sensitivity Analysis with One Variable]			
3		% Sales	Year 2	Year 3	Year 4	Year 5
4						
5		1%				
6		2%				
7		3%				
8		4%				
9		5%				
10		6%				
11		7%				
12		8%				

In the first column (range L5:L12) we have arranged the different values that we want to test for our variable "Sales Growth", from 1% to 8%. Results will appear in the range M5:P5 (in blue). We must ALWAYS leave a blank row, in our case range L4:P4. **This is where we will introduce the linking formulas**, which we will explain below.

For our second analysis, we assemble the following table:

	L	M	N	O	P
13	[Sensitivity Analysis with Two Variables]				
14		6%	7%	8%	9%
15	10%				
16	11%				
17	12%				
18	13%				
19	14%				
20	15%				
21	16%				
22	17%				

In this case, we have arranged Column (range L15:L22) with the values referring to our variable "Expenses Growth" (from 10% to 17%) and Row (range M14: P14) the values of "Sales Growth" (from 6% to 9%). We leave cell L14 free, which is where we will finally have our linking formula.

Running the one-variable sensitivity analysis

Once these "skeletons" have been created, we proceed to apply the **DATA TABLE** tool. The first step is to go to cell M4 and write the linking formula. It is always done in the upper right cell in relation to the first value analyzed (in our example, in relation to cell L5). The linking formula is nothing more than a formula that refers to the cell where the formula that we want to recalculate is located.

In our exercise we want to see how changes in sales increases (which is a data input) affect the gross margin for year 2 and consecutive years, which are data outputs. The formula that we must write in cell M4 is =G8 and we copy to the right until P4, so that we will have the gross margin of the four years (we do not consider year one because the sales increases occur from the second year).

M4					
	L	M	N	O	P
2	[Sensitivity Analysis with One Variable]				
3	% Sales	Year 2	Year 3	Year 4	Year 5
4		385 €	424 €	466 €	512 €
5	1%				
6	2%				
7	3%				

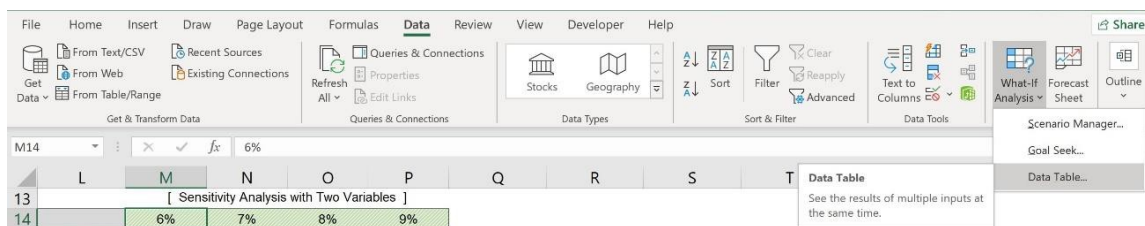
Once this is done, we proceed to select the range L4:P12:

	K	L	M	N	O	P
2		[Sensitivity Analysis with One Variable]				
3		% Sales	Year 2	Year 3	Year 4	Year 5
4			385 €	424 €	466 €	512 €
5		1%				
6		2%				
7		3%				
8		4%				
9		5%				
10		6%				
11		7%				
12		8%				

In this case:

- In column L, this range contains the values of the variable that we want to analyze (Sales Growth %).
- To its right are the cells in which Excel will return the result.
- The range M4:P4 is for the formulas.
- Cell L4 should be left blank (the reason is none other than because this tool is designed that way).

With the range selected, we go to the tool. We can find it in the same place as *Goal Seek* and *Scenario Manager*. *Data Table* will be in the *Data* tab in *What-If-Analysis*:



	L	M	N	O	P	
1						
2		[Sensitivity Analysis with One Variable]				
3		% Sales	Year 2	Year 3	Year 4	Year 5
4						
5		1%	<div><div>Data Table</div><div><div>?</div><div>×</div></div><div>Row input cell: <input type="text"/></div><div>Column input cell: <input type="text"/></div><div><div>OK</div><div>Cancel</div></div></div>			
6		2%				
7		3%				
8		4%				
9		5%				
10		6%				
11		7%				
12		8%				
13		[Sensitivity Analysis with Two Variables]				
14			6%	7%	8%	9%
15		10%				
16		11%				
17		12%				
18		13%				
19		14%				
20		15%				
21		16%				
22		17%				

?

×

Data Table

Row input cell:

Column input cell:

OK

Cancel

As we can see, the tool allows us to enter up to two variables: one regarding Row and the other regarding Column. In our case, we are currently handling a single variable and we have it arranged in a column (specifically in the range L5:L12): that is, we must fill in the column input cell. We need to indicate in which cell of our data entry the value of the variable that we are going to analyze is located (that is, the value of the "Sales Growth"). In our case, this value is in cell C5:

	A	B	C
1			
2		[Data Input]	
3		Sales Year 1	1.250 €
4		Expenses Year 1	300 €
5		Sales Growth	10%
6		Expenses Growth	20%
7		COGS	72%

	L	M	N	O	P
1					
2		[Sensitivity Analysis with One Variable]			
3	% Sales	Year 2	Year 3	Year 4	Year 5
4					
5	1%	<div data-bbox="678 1097 1098 1361"> <p>Data Table ? X</p> <p>Row input cell: <input type="text"/> ↑</p> <p>Column input cell: <input type="text" value="\$C\$5"/> ↑</p> <p>OK Cancel</p> </div>			
6	2%				
7	3%				
8	4%				
9	5%				
10	6%				
11	7%				
12	8%				

Now we only have to click OK and Excel will take care of calculating and arranging the results in the table generated for this purpose:

[Sensitivity Analysis with One Variable]				
% Sales	Year 2	Year 3	Year 4	Year 5
	385 €	424 €	466 €	512 €
1%	354 €	357 €	361 €	364 €
2%	357 €	364 €	371 €	379 €
3%	361 €	371 €	382 €	394 €
4%	364 €	379 €	394 €	409 €
5%	368 €	386 €	405 €	425 €
6%	371 €	393 €	417 €	442 €
7%	375 €	401 €	429 €	459 €
8%	378 €	408 €	441 €	476 €

Once again, all this is possible by having made use of the DIO model. What Excel has done is:

- Substituted in our data input (specifically in cell C5) each of the values that we have indicated in the range L5:L12
- Then it has returned the result generated by these values on our data output, referring to the gross margin (because we have indicated this through our linking formula, =G8).

We can proceed to check by selecting another scenario from those created; the results of the sensitivity analysis also change automatically:

Optimistic Scenario

[Sensitivity Analysis with One Variable]

% Sales	Year 2	Year 3	Year 4	Year 5
	754 €	845 €	946 €	1.060 €
1%	680 €	687 €	694 €	701 €
2%	687 €	701 €	715 €	729 €
3%	694 €	715 €	736 €	758 €
4%	700 €	728 €	758 €	788 €
5%	707 €	743 €	780 €	819 €
6%	714 €	757 €	802 €	850 €
7%	721 €	771 €	825 €	883 €
8%	727 €	786 €	848 €	916 €

Pessimistic Scenario

[Sensitivity Analysis with One Variable]

% Sales	Year 2	Year 3	Year 4	Year 5
	270 €	292 €	315 €	340 €
1%	253 €	255 €	258 €	260 €
2%	255 €	260 €	265 €	271 €
3%	258 €	265 €	273 €	281 €
4%	260 €	270 €	281 €	292 €
5%	263 €	276 €	289 €	304 €
6%	265 €	281 €	298 €	316 €
7%	268 €	286 €	306 €	328 €
8%	270 €	292 €	315 €	340 €

Sensitivity analysis with two variables

Let's continue with our case and example. In the event that we want to contrast what results we would obtain in the gross profit of Year 5 by combining different options for sales growth and expenses growth, we must propose a sensitivity analysis with two variables.

The skeleton of the table is the one shown below, where we have in a row the different percentages related to the increase in sales (from 6% to 9%) and in a column the increases in expenses (from 10% to 17 %):

	K	L	M	N	O	P
13			[Sensitivity Analysis with Two Variables]			
14			6%	7%	8%	9%
15		10%				
16		11%				
17		12%				
18		13%				
19		14%				
20		15%				
21		16%				
22		17%				

We start by introducing the linking formula for this analysis:

- The cell where we must enter it is the only one that remains free in the table: (L14).
- Since we want to calculate the gross profit for year five and the formula for this is found in cell J11, the formula we write in cell L14 is: =J11.

PPMT						
	X	✓	fx	=J11		
	K	L	M	N	O	P
13			[Sensitivity Analysis with Two Variables]			
14		=J11	6%	7%	8%	9%
15		10%				
16		11%				
17		12%				
18		13%				
19		14%				
20		15%				
21		16%				
22		17%				

[Sensitivity Analysis with Two Variables]					
-110 €	6%	7%	8%	9%	
10%					
11%					
12%					
13%					
14%					
15%					
16%					
17%					

We now select the entire table (the range L14:P14) and with the range selected we open the *Data Table* tool again.

- In the **Row input cell** option, we enter the cell of our data entry where the value relative to the Sales Growth can be found (that is, C5).
- In the **Column input cell** option, we enter the cell of the data entry where the value relative to the expenses growth is (that means C6).

[Sensitivity Analysis with Two Variables]

-110 €	6%	7%	8%	9%
10%	<div> <div>Data Table ? X</div> <div> <div>Row input cell: C5</div> <div>Column input cell: C6</div> <div>OK Cancel</div> </div> </div>			
11%				
12%				
13%				
14%				
15%				
16%				
17%				

We click OK, and we obtain the following result (starting from the initial scenario):

[Sensitivity Analysis with Two Variables]

-110 €	6%	7%	8%	9%
10%	3 €	20 €	37 €	55 €
11%	-14 €	3 €	21 €	39 €
12%	-30 €	-13 €	4 €	22 €
13%	-47 €	-30 €	-13 €	5 €
14%	-65 €	-48 €	-31 €	-13 €
15%	-83 €	-66 €	-49 €	-31 €
16%	-101 €	-84 €	-67 €	-49 €
17%	-120 €	-103 €	-86 €	-68 €

Understanding these tables is not complicated. Let's look at an example. Starting from the initial data, if the Sales Growth is 9% and the Expenses Growth is 11%, the Operating Profit obtained in the fifth year will be € 39.

[Sensitivity Analysis with Two Variables]

-110 €	6%	7%	8%	9%
10%	3 €	20 €	37 €	55 €
11%	-14 €	3 €	21 €	39 €
12%	-30 €	-13 €	4 €	22 €
13%	-47 €	-30 €	-13 €	5 €
14%	-65 €	-48 €	-31 €	-13 €
15%	-83 €	-66 €	-49 €	-31 €
16%	-101 €	-84 €	-67 €	-49 €
17%	-120 €	-103 €	-86 €	-68 €

Congratulations - you have solved the final Challenge in this course!