What-If Analysis Tools in Excel

Cosma Emil
"Ovidius" University of Constanta, Faculty of Economic Sciences
ecosma@univ-ovidius.ro

Abstract

What-If Analysis *tools are available in Excel and they can be used for a variety of purposes. This paper is concerned with their description, as well as a few examples of their applications in financial models. For this reason, two types of data tables are taken into account: one-variable data tables and two-variable data tables. We will look at how these can be structured in order to show us the effect that a loan could have on our yearly budget, by experimenting with different values for the interest rate and total number of payments. We will also employ the use of PMT and IPMT functions.*

Key words: analysis, table, pmt, ipmt.
J.E.L. classification: C3

1. Introduction

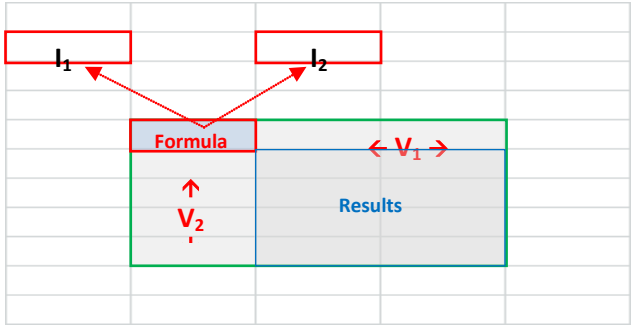
When a formula already exists, *Data Tables* help us see how it is affected by variables (in this case, we will use one or two variables). So, suppose that we have a formula in which one or two variables were included, or perhaps a larger number of formulas that have one variable in common. A ***What-If Analysis Data Table*** would make it easy for us to analyze a variety of possible outcomes, as they are all gathered in one place, in the form of a table, which is straightforward and readable. Moreover, data can be continuously updated. As long as the workbook enables automatic recalculations, the results will be updated as well.

2. Theoretical background. Generating a Data Table

Tables retrieve input data from rows and columns, use them in formulas and then display them in tabular form. The main idea behind their design is represented by defining a formula which is only written once, but applied multiple times. In order to create a two variables data table, you have to execute the following steps:

a. You apply the formula for two variables (I_1 and I_2), located in two cells (the row input cell and the column input cell respectively):

Figure no. 1. Screenshot



Source: (Weterings, *Excel Easy*)

b. Fill in the input values, for which the same formula is applied, thus:
   - on the right of the formula, on the same row: input values V_1 of type I_1;
   - under the formula, on the same column: input values V_2 of type I_2;
c. **Select the cells** which will **make up the table** (the selection begins with the formula and it includes input values V_1 and V_2);
d. On the **Data** tab, click on **What-If Analysis**, option **Data Table;**
e. In the **Data Table** window, fill in **Row input cell** and **Column input cell** – the addresses of the input cells for rows and columns (they include values I_1 and I_2).

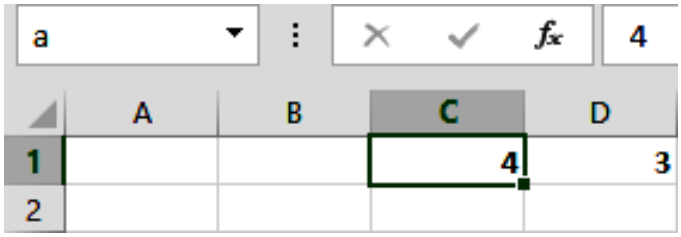
3. Data table basics

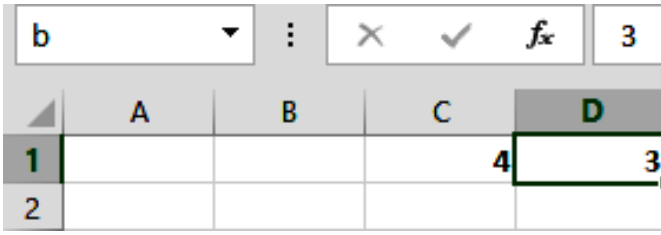
Create either one-variable or two-variable data tables, depending on the number of variables and formulas that you need to test.

Example: **Calculate the expression a+2*b** b for different values of **a** and **b** *(Figures no. 2 – 6)*.

a) In two cells type the input values (for example **4** and **3**) and reference the input cells as **a** and **b**, respectively:

Figure no. 2. Screenshot

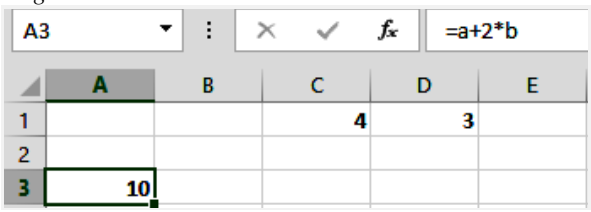




Source: (Cosma E., 2018)

b) In a different cell on the worksheet, enter the formula that refers to the two input cells, **a**, **b** (**=a+2*b**):

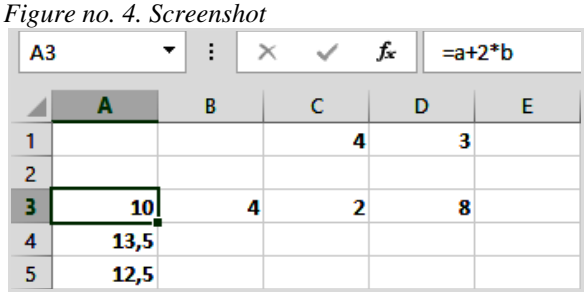
Figure no. 3. Screenshot



Source: (Cosma E., 2018)

c) Type one list of input values for a in the same row as the formula, to its right, in this case **a(4, 2, 8)**, and the second list of input values for b in the same column, below the formula **b(13,5, 12,5)**:

Figure no. 4. Screenshot

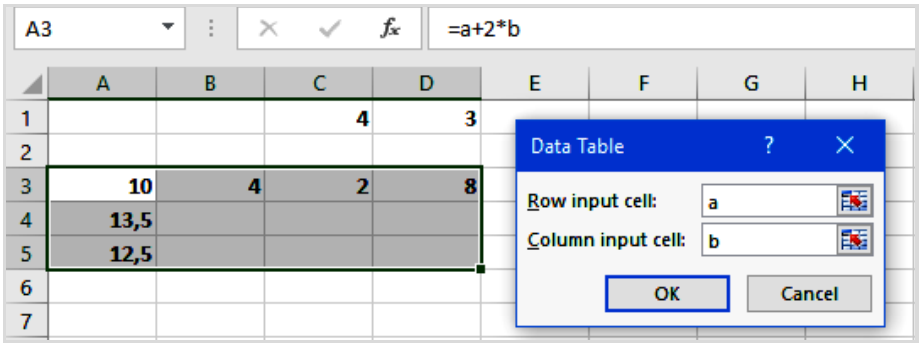


Source: (Cosma E., 2018)

d) Select the range of cells that contains the formula, both the row and column of values (**B3:D5** and **A2:A5**), and the cells in which you want the calculated values (**A3:D5**). On the **Data** tab, in the **Data Tools** group, click on **What-If Analysis** ☞ **Data Table** and complete the Dialog Box which appears, containing the **Row input cell** and **Column**

input cell boxes (**a** – the row input cell, for values of type **a**; **b** – the column input cell, for values of type **b**). Click OK.

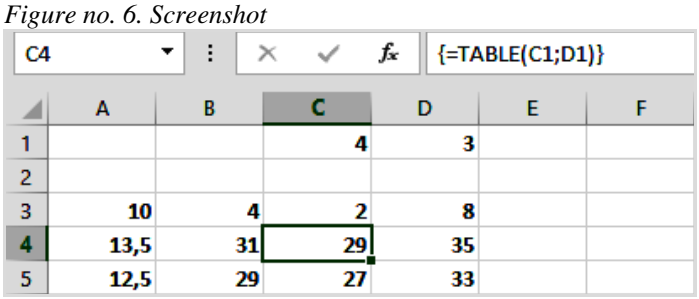
Figure no. 5. Screenshot



Source: (Cosma E., 2018)

e) The table displays the output values derived according to the formula – **{=Table(C1;D1)}**:

Figure no. 6. Screenshot



	A	B	C	D	E	F
1			4	3		
2						
3	10	4	2	8		
4	13,5	31	29	35		
5	12,5	29	27	33		

Source: (Cosma E., 2018)

4. What-If Analysis for financial modeling

What-If Analysis has numerous applications in finance (for instance, **Rate** – Interest rate and **Nper** – Number of payments)

4.1. Two-variable data tables

In the following example we use a data table to vary the interest rate and term length that are used in a loan to determine possible monthly payment amounts (*Figures no. 7*).

Example: Suppose that we have a **$32,000** loan over a period of **5** years, with an annual interest rate of **10%**. We would like to see how the values for monthly payments would change for different total numbers of payments (in this case, **3**, **6**, and **4** years) and for different values of the annual interest rate (keeping in mind that **11%** is the maximum value).

Figure no. 7. Screenshot

B8 | =PMT(D5/12;D4*12;D3)

	A	B	C	D	E
1	The payment for a loan based				
2		on constant payments and a constant interest rate			
3	*Amount of loan*			$32.500	
4	*The total number of payments (years)*			5	
5	*Annual interest rate*			10%	
6					
7			The total number of payments (years)		
8		-$690,53	3	6	4
9	Annual interest rate	8%	-$1.018,43	-$569,83	-$793,42
10		9%	-$1.033,49	-$585,83	-$808,76
11		11%	-$1.064,01	-$618,61	-$839,98
12		9,2%	-$1.036,52	-$589,06	-$811,85
13		9,4%	-$1.039,55	-$592,30	-$814,95
14		9,6%	-$1.042,59	-$595,55	-$818,05

Source: (Microsoft, *Excel - Office Support*)

- Create a two-variable **Data Table** (as explained before);
- **D4** is the row input cell and **D5** is the column input cell;
- We will use the **PMT** function for the formula in cell **B8** - type in the arguments of the function (**=PMT(D5/12;D4*12;D3**).

4.2. One-variable data tables

One-variable Data Tables are a particular case of two-variable Data Tables - explained before (*Figures no. 8 - 11*).

Example: Suppose that we have a **$32,000** loan over a period of **5** years, with an annual interest rate of **10%**. We would like to see how the values for monthly payments would change for different values of the annual interest rate (keeping in mind that **11%** is the maximum value). We will also calculate the interest payment for each case.

a) Create a spreadsheet similar to the one in the image below (cells **D3**, **D4**, **D5** contain data of numeric data types):

Figure no. 8. Screenshot

	A	B	C	D
1	The payment for a loan based			
2		on constant payments and a constant interest rate		
3	*Amount of loan*			$32.500
4	*The total number of payments (years)*			5
5	*Annual interest rate*			10%
6				
7			Monthly payment	The interest payment
8		Interest rate		
9		8%		
10		9%		
11		11%		
12		9,2%		
13		9,4%		
14		9,6%		

Source: (Cosma E., 2018)

b) In cells **C8** and **D8**, write the desired formulas using the **PMT** and **IPMT** functions: **=PMT(D5/12;D4*12;D3)** , **=IPMT(D5/12;D4*12;D4*12;D3)**:

Figure no.9. Screenshot

	A	B	C	D
1	The payment for a loan based			
2		on constant payments and a constant interest rate		
3	*Amount of loan*			$32.500
4	*The total number of payments (years)*			5
5	*Annual interest rate*			10%
6				
7			Monthly payment	The interest payment
8		Interest rate	-$690,53	-$5,71
9		8%		
10		9%		
11		11%		
12		9,2%		
13		9,4%		
14		9,6%		

Source: (Cosma E., 2018)

c) Select the data table, the cells ranging from **B8:D14** (it contains the two cells in which the two formulas were typed and the interest rate column). We have only one input cell, on the column (**D5**):

Figure no. 10. Screenshot

	A	B	C	D	E	F	G	H
1	The payment for a loan based							
2		on constant payments and a constant interest rate						
3	*Amount of loan*			$32.500				
4	*The total number of payments (years)*			5				
5	*Annual interest rate*			10%				
6								
7			Monthly payment	The interest payment				
8		Interest rate	-$690,53	-$5,71				
9		8%						
10		9%						
11		11%						
12		9,2%						
13		9,4%						
14		9,6%						

Data Table ? ×
Row input cell:
Column input cell: d5
OK Cancel

Source: (Cosma E., 2018)

d) Click OK The following values are displayed:

Figure no. 11. Screenshot

C11 {=TABLE(;D5)}

	A	B	C	D
1	The payment for a loan based			
2		on constant payments and a constant interest rate		
3	*Amount of loan*			$32.500
4	*The total number of payments (years)*			5
5	*Annual interest rate*			10%
6				
7			Monthly payment	The interest payment
8		Interest rate	-$690,53	-$5,71
9		8%	-$658,98	-$4,36
10		9%	-$674,65	-$5,02
11		11%	-$706,63	-$6,42
12		9,2%	-$677,81	-$5,16
13		9,4%	-$680,97	-$5,29
14		9,6%	-$684,15	-$5,43

Source: (Cosma E., 2018)

5. Conclusions

By employing the use of ***What-If Analysis*** in *Excel*, it is possible to explore a variety of results, derived from distinctive sets of values included in one or more formulas. A real-life financial situation in which ***What-If Analysis*** would prove useful is when you want to create two different budgets, each of them based on a different level of revenue. You could try another approach as well: perhaps you already have a resulting value, and you would like to know which input values would lead to that result. *Excel* is endowed for a wide range of purposes, depending on what you are looking to achieve.

6. References

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