



Absolute vs. Relative References in Excel

By Nate Moore, CPA, MBA, CMPE

The ability to create one formula and copy it hundreds or thousands of times is a great feature of spreadsheets like Microsoft Excel. You can make copying those formulas even more powerful if you understand the difference between absolute and relative cell references in Excel.

Relative References

Formulas like $=A1+B1$ are relative references in Excel. If the formula $=A1+B1$ is stored in cell C1, copying the formula from cell C1 to cell C2 (changing the row of the copied formula) will change the formula in C2 to be $=A2+B2$. Copying the formula from cell C1 to cell D1 (changing the column of the copied formula) will result in the formula $=B1+C1$ being stored in cell D1. The row and column references in the copied cells change as the destination cell changes.

Cell references like A1 and B1 are called relative cell references because when formulas with relative references are copied, the cell references change proportionately, in relation to the original cell. If our $=A1+B1$ cell is copied from cell C1 100 rows down to cell C101, the new formula in cell C101 will change by the same 100 rows to be $=A101+B101$.

Most of the time, relative references work just fine when copying formulas, but consider the example in Figure 1. A manager is calculating 2015 salaries based on 2014 salaries, plus a 3 percent increase. The formula in cell C4 is $=B4*(1+B1)$, which works just fine. The formula in cell C4 is also shown in cell D4 for reference. Watch what happens when the manager copies the formula from C4 to cells C5 through C9, as shown in Figure 2. Disaster strikes! (Unless you're Larita, Pamela, or Jayson!)

Notice what Excel did to the copied formulas as shown in column D of Figure 2. Since the formula was copied down several rows and the formula was comprised of relative references, the cell references also changed relative to the original formula. Instead of basing each salary increase on cell B1, Margery's salary increase was based on \$73,500 times the text "2014 Salary," which resulted

in an error. Pamela's salary increase was based on \$120,000 times $1+\$68,000$ (cell B5), which is clearly wrong.

Absolute References

The solution is to let the part of the formula that references each employee's 2014 salary remain a relative reference, but to hold the cell reference constant (cell B1) that refers to the percentage increase. Holding a cell reference constant when a formula is copied is known as an absolute reference. A relative reference to cell B1 in Excel is entered as B1. An absolute reference to cell B1 in Excel is stored as $\$B\1 . The "\$" symbol in front of the column reference (B) and the row reference (1) locks the formula to always reference cell B1, no matter where the cell is copied. Figure 3 shows the absolute reference at work. Notice that the formula in cell C8 is now $=B8*(1+\$B\$1)$. The B8 part of the formula is relative. In the next row down, that part of the formula changes to B9. The $\$B\1 part of the formula is absolute. No matter where the formula is copied in the spreadsheet, that part of the formula will always reference cell $\$B\1 .

Mixed References

Excel allows cell references to be mixed references, where the row or column part of the reference is absolute and the other part of the cell reference is relative. For example, $\$C5$ locks in column C as absolute, while row 5 is relative. If a formula referencing $\$C5$ is copied from cell D5 to cell D7, the copied formula will reference cell C7 because column C is absolute, while row 5 is relative. Figures 4 and 5 are examples of when mixed references are helpful. In Figure 4, the mixed reference keeps the column absolute while leaving the row reference relative. The percentage increase or decrease varies by specialty and is stored in column B, so the formula in the highlighted cell, D21, is $=C21*(1+\$B21)$. As the formula is copied throughout the table, the formula references the increase or decrease, which is an absolute column reference to column B.

In Figure 5, the mixed reference keeps the row absolute while



FIGURE 1

	A	B	C	D
1	2015 Salaries	3%		
2				
3	Employee	2014 Salary	2015 Salary	Formula
4	Jorgensen, Zula I.	\$ 28,000	\$ 28,840	=B4*(1+B1)
5	Lemaster, Lucienne	\$ 68,000		
6	Elsberry, Margery K.	\$ 73,500		
7	Gain, Larita	\$ 43,000		
8	Ehler, Pamela B.	\$ 120,000		
9	Frederickson, Jayson B.	\$ 41,000		

FIGURE 5

	A	B	C	D	E	F
27	FORECAST FUTURE COLLECTIONS BY LOCATION					
28						
29		2013	2014	2015	2016	2017
30	In(De)crease %		1.4%	-3.0%	2.0%	1.5%
31	LOCATION					
32	Zephyr	\$ 1,500,000	\$ 1,521,000	\$ 1,475,370	\$ 1,504,877	\$ 1,527,451
33	Light Wind	\$ 1,800,000	\$ 1,825,200	\$ 1,770,444	\$ 1,805,853	\$ 1,832,941
34	Gentle Gust	\$ 1,300,000	\$ 1,318,200	\$ 1,278,654	\$ 1,304,227	\$ 1,323,790
35	Draft	\$ 2,100,000	\$ 2,129,400	\$ 2,065,518	\$ 2,106,828	\$ 2,138,431
36	Air Current	\$ 1,900,000	\$ 1,926,600	\$ 1,868,802	\$ 1,906,178	\$ 1,934,771
37	Easy Task	\$ 1,700,000	\$ 1,723,800	\$ 1,672,086	\$ 1,705,528	\$ 1,731,111

FIGURE 2

	A	B	C	D
1	2015 Salaries	3%		
2				
3	Employee	2014 Salary	2015 Salary	Formula
4	Jorgensen, Zula I.	\$ 28,000	\$ 28,840	=B4*(1+B1)
5	Lemaster, Lucienne	\$ 68,000	\$ 68,000	=B5*(1+B2)
6	Elsberry, Margery K.	\$ 73,500	#VALUE!	=B6*(1+B3)
7	Gain, Larita	\$ 43,000	\$ 1,204,043,000	=B7*(1+B4)
8	Ehler, Pamela B.	\$ 120,000	\$ 8,160,120,000	=B8*(1+B5)
9	Frederickson, Jayson B.	\$ 41,000	\$ 3,013,541,000	=B9*(1+B6)

FIGURE 3

	A	B	C	D
1	2015 Salaries	3%		
2				
3	Employee	2014 Salary	2015 Salary	Formula
4	Jorgensen, Zula I.	\$ 28,000	\$ 28,840	=B4*(1+\$B\$1)
5	Lemaster, Lucienne	\$ 68,000	\$ 70,040	=B5*(1+\$B\$1)
6	Elsberry, Margery K.	\$ 73,500	\$ 75,705	=B6*(1+\$B\$1)
7	Gain, Larita	\$ 43,000	\$ 44,290	=B7*(1+\$B\$1)
8	Ehler, Pamela B.	\$ 120,000	\$ 123,600	=B8*(1+\$B\$1)
9	Frederickson, Jayson B.	\$ 41,000	\$ 42,230	=B9*(1+\$B\$1)

FIGURE 4

	A	B	C	D	E	F	G
16							
17	FORECAST FUTURE COLLECTIONS BY SPECIALTY						
18							
19		Percentage					
20	Specialty	In(De)crease	2013	2014	2015	2016	2017
21	Cardiology	2.5%	\$ 2,100,000	\$ 2,152,500	\$ 2,206,313	\$ 2,261,470	\$ 2,318,007
22	Family Practice	3.0%	\$ 2,400,000	\$ 2,472,000	\$ 2,546,160	\$ 2,622,545	\$ 2,701,221
23	General Surgery	-2.0%	\$ 3,200,000	\$ 3,136,000	\$ 3,073,280	\$ 3,011,814	\$ 2,951,578
24	Radiology	-8.0%	\$ 5,000,000	\$ 4,600,000	\$ 4,232,000	\$ 3,893,440	\$ 3,581,965
25	Urology	3.5%	\$ 2,500,000	\$ 2,587,500	\$ 2,678,063	\$ 2,771,795	\$ 2,868,808

leaving the column reference relative. The percentage increase or decrease varies by year for each location and is stored in row 30, so the formula in the highlighted cell, D32, is =C32*(1+D\$30). As this formula is copied throughout the table, the formula references the increase or decrease, which is an absolute reference to row 30.

The ability to fluently use relative, absolute, and mixed references in formulas adds a tremendous amount of flexibility to spreadsheets. Relative, absolute, and mixed references can also be used in functions, making the functions more powerful, as well. The ability to use one formula correctly throughout a spreadsheet, rather than having different versions of a formula to deal with absolute and mixed cell references, makes a spreadsheet more accurate and easier to maintain. The next time you can use an absolute or mixed cell reference in a formula, try it. You'll be glad you did. ■

Nate Moore, CPA, MBA, FACMPE, writes custom SQL server code to mine practice management data for analysis in Excel, web pages, and via email. Nate's first book, *Better Data, Better Decisions: Using Business Intelligence in the Medical Practice*, written with Mona Reimers, was recently published by MGMA. His free Excel videos have been viewed over one million times and are available at mooresolutionsinc.com. Like PivotTableGuy on Facebook or follow @PivotTableGuy on Twitter to be notified each time an Excel video is released.