Covariance matrix calculation

Previously we calculated the covariance matrix using the COVAR function. However that was somewhat cumbersome as we constructed the square covariance matrix row by row. There is another way to calculate the covariance matrix that is quicker, using the "Data Analysis" add-in that comes with Excel. We illustrate this below.

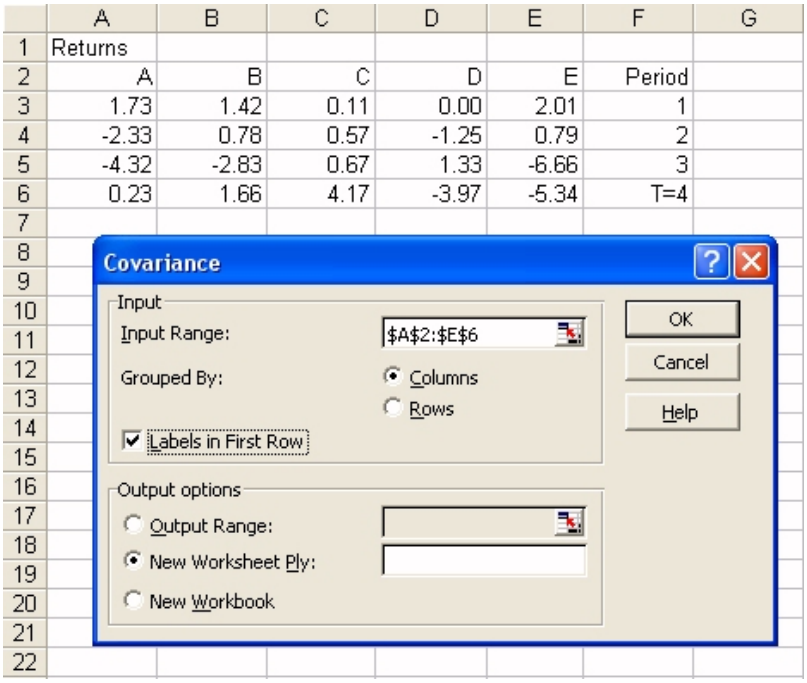
In Excel 2003 (or earlier) go to the Tools menu and select Data Analysis. If Data Analysis is not on the Tools menu then install it (as we did before with Solver).

If you are using Office 2007 (or later) it is a different procedure. In those versions of Office you install the Data Analysis add-in by first clicking the Microsoft Office button (large circular button  top left of the screen when Excel is opened), then Excel options, then Add-ins, then Go (bottom of screen), then tick the box next to Analysis ToolPak and the Data Analysis add-in will be added in. In those versions of Office the add-in is found in the Analysis group on the Data tab.

Although the procedures for installing (and finding on the menu) the Data Analysis add-in are different in different versions of Office once you start using it different versions look the same.

Select Data Analysis and then select Covariance. For simplicity we just show below in Excel the returns that we had before.

Here by highlighting the cells we have the Input Range as the cells containing the column labels and the returns, i.e. A2:E6, and we have also ticked "Labels in First Row"

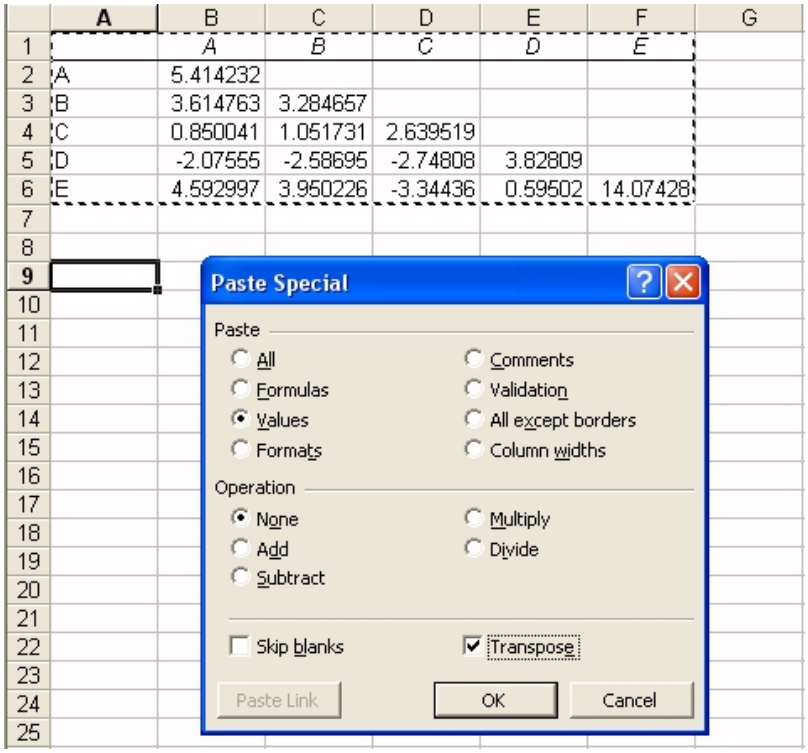


Clicking OK we will now have a new worksheet:

	A	B	C	D	E	F	G
1		*A*	*B*	*C*	*D*	*E*	
2	A	5.414232					
3	B	3.614763	3.284657				
4	C	0.850041	1.051731	2.639519			
5	D	-2.07555	-2.58695	-2.74808	3.82809		
6	E	4.592997	3.950226	-3.34436	0.59502	14.07428	
7							

This (irritatingly) has the covariances but only for half the matrix, technically the lower triangle. The square covariance matrix is a symmetric matrix so we need fill in the upper triangle.

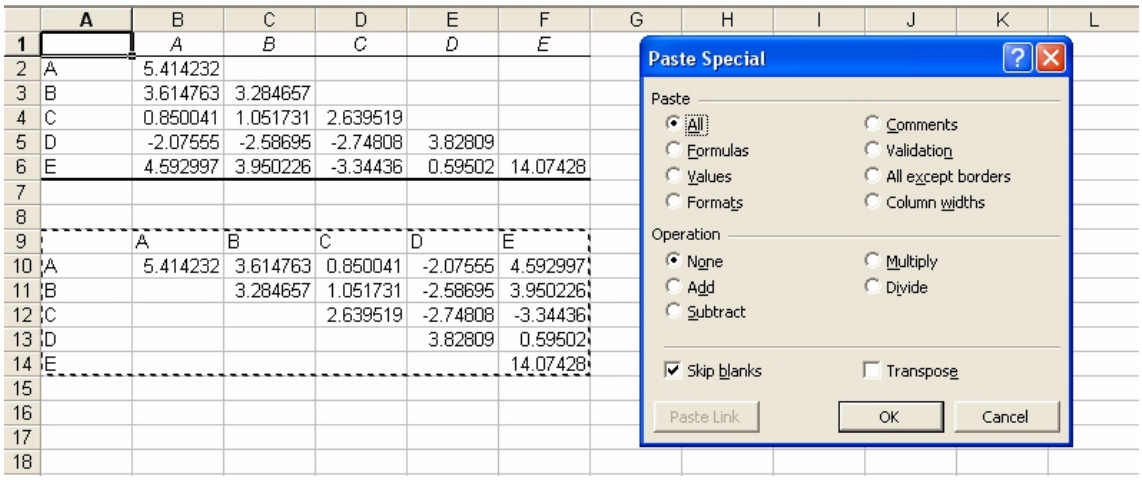
To get the upper triangle copy the matrix (here A1:F6 as below) and then do Paste Special but using Transpose and Values:



Clicking OK we get

	A	B	C	D	E	F	G
1		*A*	*B*	*C*	*D*	*E*	
2	A	5.414232					
3	B	3.614763	3.284657				
4	C	0.850041	1.051731	2.639519			
5	D	-2.07555	-2.58695	-2.74808	3.82809		
6	E	4.592997	3.950226	-3.34436	0.59502	14.07428	
7							
8							
9		A	B	C	D	E	
10	A	5.414232	3.614763	0.850041	-2.07555	4.592997	
11	B		3.284657	1.051731	-2.58695	3.950226	
12	C			2.639519	-2.74808	-3.34436	
13	D				3.82809	0.59502	
14	E					14.07428	
15							

Now to get the square covariance matrix we copy the lower matrix and do Paste Special over the upper matrix, but where we use Skip Blanks, as below



	A	B	C	D	E	F
1		A	B	C	D	E
2	A	5.414232				
3	B	3.614763	3.284657			
4	C	0.850041	1.051731	2.639519		
5	D	-2.07555	-2.58695	-2.74808	3.82809	
6	E	4.592997	3.950226	-3.34436	0.59502	14.07428
7						
8						
9		A	B	C	D	E
10	A	5.414232	3.614763	0.850041	-2.07555	4.592997
11	B		3.284657	1.051731	-2.58695	3.950226
12	C			2.639519	-2.74808	-3.34436
13	D				3.82809	0.59502
14	E					14.07428
15						
16						
17						
18						

and clicking OK gives

	A	B	C	D	E	F
1		A	B	C	D	E
2	A	5.414232	3.614763	0.850041	-2.07555	4.592997
3	B	3.614763	3.284657	1.051731	-2.58695	3.950226
4	C	0.850041	1.051731	2.639519	-2.74808	-3.34436
5	D	-2.07555	-2.58695	-2.74808	3.82809	0.59502
6	E	4.592997	3.950226	-3.34436	0.59502	14.07428

which is the square (and symmetric) covariance matrix we wanted.

One thing to note about this is that using COVAR is dynamic, so if returns change covariances change. The Data Analysis approach is static, so if returns are changed the covariances will not change unless you go through the entire procedure again.