

### Markowitz example question

The table below shows stock prices for five stocks over a number of time periods.

Period	A	B	C	D	E
0	39.7	3.1	38.2	72.9	3.6
1	73.5	0.5	96.3	60.4	77
2	17.3	42.3	62.2	49.7	91.5
3	31.6	70.8	57.2	5.2	54.7
T=4	64.4	86.9	76.1	27.1	14.3

For example in period 3 the stock/share price for stock A is 31.6.

Plot the unconstrained efficient frontier for these stocks.

## Markowitz example solution

A suitable spreadsheet is shown below

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Stock prices							Returns					
2	A	B	C	D	E	Period		A	B	C	D	E	Period
3	39.7	3.1	38.2	72.9	3.6	0							0
4	73.5	0.5	96.3	60.4	77	1		61.59	-182.45	92.46	-18.81	306.29	1
5	17.3	42.3	62.2	49.7	91.5	2		-144.66	443.79	-43.71	-19.50	17.25	2
6	31.6	70.8	57.2	5.2	54.7	3		60.25	51.51	-8.38	-225.73	-51.45	3
7	64.4	86.9	76.1	27.1	14.3	T=4		71.20	20.49	28.55	165.09	-134.16	T=4
8							Average	12.09	83.33	17.23	-24.74	34.48	
9													
10	Weights w(i)							Covariance COVAR (2dp)					
11	A	B	C	D	E			A	B	C	D	E	
12	0.00	1.00	0.00	0.00	0.00			8208.22	-18726.44	3178.13	253.23	512.54	A
13	Working							-18726.44	51384.27	-10464.83	-1304.82	-16280.00	B
14	-18726.44	51384.27	-10464.83	-1304.82	-16280.00			3178.13	-10464.83	2539.47	1855.74	5447.61	C
15								253.23	-1304.82	1855.74	19123.99	-3305.02	D
16	sum w(i)	1						512.54	-16280.00	5447.61	-3305.02	27499.75	E
17	risk	51384.27											
18	return	actual	desired				do 5 intermediate	Risk	Return	min	max		
19		83.33	83.33				points	19123.99	-24.74	-24.74	83.33		
20							return step	6978.69	-6.73				
21	For an array formula:						18.01	1960.55	11.29				
22	highlight cells where the results will go							28.20	29.30				
23	type formula							3013.59	47.31				
24	do ctrl-shift-enter							16637.37	65.32				
25								51384.27	83.33				

  

**Solver Parameters**

Set Target Cell:

Equal To:  Max  Min  Value of:

By Changing Cells:

Subject to the Constraints:

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The efficient frontier (more strictly the entire frontier, including both efficient and inefficient parts) is shown below.

