

Market	Security	$r_i$	risk	correlation <sub>A,B</sub>
I	A	0.22	0.3	0.15
	B	0.31	0.32	
II	A	0.26	0.29	-0.06
	B	0.34	0.33	
III	A	0.18	0.2	0.09
	B	0.41	0.38	

Market I

CovM

0.09 0.0144  
0.0144 0.1024

VRS

0.18 0.0288 1 0  
0.0288 0.2048 1 0  
1 1 0 1

wi

Rp

3.056235 -3.05623 0.537897 1 0.537897  
-3.05623 3.056235 0.462103 2 0.462103  
0.537897 0.462103 -0.11013 lambda1 -0.11013

0.261589

Proof

1

Proof

1.00 0.00 0.00  
0.00 1.00 0.00  
0.00 0.00 1.00

Market II

CM

0.0841 -0.00574  
-0.00574 0.1089

VRS

0.1682 -0.01148 1 0  
-0.01148 0.2178 1 0  
1 1 0 1

wi

Rp

2.445179 -2.44518 0.56064 0.56064  
-2.44518 2.445179 0.43936 0.43936  
0.56064 0.43936 -0.08925 -0.08925

0.295149

Proof

1

Market III

CM

0.04 0.00684  
0.00684 0.1444

VRS

0.08 0.01368 1 0  
0.01368 0.2888 1 0  
1 1 0 1

wi

Rp

2.928772 -2.92877 0.805764 0.805764  
-2.92877 2.928772 0.194236 0.194236

0.224674

0.805764 0.194236 -0.06712 -0.06712  
Proof 1

Market	Rp	SigmaP	ratio
I	0.261589	0.234659	1.114761
II	0.295149	0.211251	1.397146
III	0.224674	0.183192	1.226445

VarP      Sigma\_P  
0.055065  0.234659

VarP      Sigma\_P  
0.044627  0.211251

VarP      Sigma\_P  
0.033559  0.183192

	Company 1	Company 2	Company 3	Correlation	
$\mu$	0.8	0.3	0.6	$\sigma_{1.2}$	-0.1
$\sigma$	1.2	0.8	1.1	$\sigma_{1.3}$	-0.5
				$\sigma_{2.3}$	0.3

CovM

1.44	-0.096	-0.66
-0.096	0.64	0.264
-0.66	0.264	1.21

vrs

2.88	-0.192	-1.32	1	0
-0.192	1.28	0.528	1	0
-1.32	0.528	2.42	1	0
1	1	1	0	1

wi

0.222691	-0.25436	0.031669	0.351616	1	0.351616
-0.25436	0.668746	-0.41439	0.313964	2	0.313964
0.031669	-0.41439	0.382718	0.33442	3	0.33442
0.351616	0.313964	0.33442	-0.51094	lambda1	-0.51094
					1

Rp

0.576134  
0.576134

E (Rp)=65%

2.88	-0.192	-1.32	1	0.8
-0.192	1.28	0.528	1	0.3
-1.32	0.528	2.42	1	0.6
1	1	1	0	0
0.8	0.3	0.6	0	0

VRS

0  
0  
0  
1  
0.65

wi

0.076093	0.050729	-0.12682	-0.34729	1.213095	1	0.441222
0.050729	0.033819	-0.08455	1.768474	-2.5246	2	0.127481
-0.12682	-0.08455	0.21137	-0.42118	1.311509	3	0.431296
-0.34729	1.768474	-0.42118	-3.84297	5.783435	lambda1	-0.08374
1.213095	-2.5246	1.311509	5.783435	-10.0384	lambda2	-0.74149

1

0.351616 0.313964 0.33442

0.178032 -0.0106 -0.07761

-0.0106 0.063087 0.027719

-0.07761 0.027719 0.135323

VarP SigmaP ratio  
0.255469 0.505439 1.139868  
0.255469  
0.255469

0.255469 0.255469 0.255469

0.441222 0.127481 0.431296

0.280335 -0.0054 -0.1256

-0.0054 0.010401 0.014515

-0.1256 0.014515 0.22508

Rp VarP SigmaP ratio  
0.65 0.282854 0.53184 1.222171

	Sec <sub>1</sub>	Sec <sub>2</sub>	Sec <sub>3</sub>	Sec <sub>4</sub>	Sec <sub>5</sub>	Sec <sub>6</sub>	Sec <sub>7</sub>	r <sub>i</sub> (%)
Sec <sub>1</sub>	80.5	82.7	85.3	85.1	123.9	22	3.5	1.9
Sec <sub>2</sub>	82.7	184.7	131.5	69.4	49.5	58	-9.9	6.1
Sec <sub>3</sub>	85.3	131.5	374.2	384.5	366.5	103.8	343.5	2.9
Sec <sub>4</sub>	85.1	69.4	384.5	684.8	599.1	51.6	502.7	4
Sec <sub>5</sub>	123.9	49.5	366.5	599.1	871.4	-21.2	520.4	5.7
Sec <sub>6</sub>	22	58	103.8	51.6	-21.2	89.7	74.4	3.4
Sec <sub>7</sub>	3.5	-9.9	343.5	502.7	520.4	74.4	574.6	4.9

161	165.4	170.6	170.2	247.8	44	7	1
165.4	369.4	263	138.8	99	116	-19.8	1
170.6	263	748.4	769	733	207.6	687	1
170.2	138.8	769	1369.6	1198.2	103.2	1005.4	1
247.8	99	733	1198.2	1742.8	-42.4	1040.8	1
44	116	207.6	103.2	-42.4	179.4	148.8	1
7	-19.8	687	1005.4	1040.8	148.8	1149.2	1
1	1	1	1	1	1	1	0

Invert\_M

0.077542	-0.00619	0.008788	-0.00971	-0.03769	-0.07775	0.045002	2.1372
-0.00619	0.007803	-0.00362	0.000167	0.001056	-0.00048	0.001254	0.044435
0.008788	-0.00362	0.007544	-0.00229	-0.00426	-0.00879	0.002623	-0.29067
-0.00971	0.000167	-0.00229	0.004278	0.004072	0.01066	-0.00718	-0.23027
-0.03769	0.001056	-0.00426	0.004072	0.02058	0.040175	-0.02394	-0.77333
-0.07775	-0.00048	-0.00879	0.01066	0.040175	0.086382	-0.0502	-1.1224
0.045002	0.001254	0.002623	-0.00718	-0.02394	-0.0502	0.032436	1.235036
2.1372	0.044435	-0.29067	-0.23027	-0.77333	-1.1224	1.235036	-30.2875

E (Rp)=5%

161	165.4	170.6	170.2	247.8	44	7	1
165.4	369.4	263	138.8	99	116	-19.8	1
170.6	263	748.4	769	733	207.6	687	1
170.2	138.8	769	1369.6	1198.2	103.2	1005.4	1
247.8	99	733	1198.2	1742.8	-42.4	1040.8	1
44	116	207.6	103.2	-42.4	179.4	148.8	1
7	-19.8	687	1005.4	1040.8	148.8	1149.2	1
1	1	1	1	1	1	1	0
1.9	6.1	2.9	4	5.7	3.4	4.9	0

0.016039	0.007661	-0.00407	-0.00315	-0.00914	-0.02351	0.016171	2.286871
0.007661	0.004685	-0.00072	-0.00131	-0.00537	-0.01269	0.007746	0.010736
-0.00407	-0.00072	0.004856	-0.00092	0.001708	0.002544	-0.0034	-0.25938
-0.00315	-0.00131	-0.00092	0.003579	0.001028	0.004877	-0.00411	-0.24623
-0.00914	-0.00537	0.001708	0.001028	0.00733	0.015	-0.01055	-0.8428
-0.02351	-0.01269	0.002544	0.004877	0.015	0.038551	-0.02477	-1.2544
0.016171	0.007746	-0.0034	-0.00411	-0.01055	-0.02477	0.01892	1.305199
2.286871	0.010736	-0.25938	-0.24623	-0.8428	-1.2544	1.305199	-30.6517
-0.37867	0.085259	-0.07916	0.040381	0.175762	0.333946	-0.17751	0.921531



		2.1372	0.044435	-0.29067	-0.23027
vrs					
	0	367.6936	7.853678	-52.9898	-41.881
	0	7.853678	0.36468	-1.69843	-0.71011
	0	-52.9898	-1.69843	31.61554	25.73579
	0	-41.881	-0.71011	25.73579	36.31192
	0	-204.776	-1.70094	82.38249	106.6853
	0	-52.7736	-2.89267	33.86451	13.33649
	0	9.238319	-0.5433	-123.312	-142.966
	1				

	wi	Rp	VarP	SigmaP	ratio
	1 2.1372	0.39525	15.14374	3.891496	0.101568
	2 0.044435				
	3 -0.29067				
	4 -0.23027				
	5 -0.77333				
	6 -1.1224				
	7 1.235036				
lambda1	-30.2875				
proof	1			0.3935	0.43703
				-0.65518	-0.04433

	vrs		12.46483	14.22203	-21.9915	-1.48441
1.9	0		14.22203	35.27677	-37.6528	-1.34447
6.1	0		-21.9915	-37.6528	160.6291	11.167
2.9	0		-1.48441	-1.34447	11.167	1.345623
4	0		1.755887	0.779106	-8.64797	-0.95644
5.7	0		3.595548	10.52776	-28.2459	-0.95001
3.4	0		0.57518	-1.80691	-93.9892	-9.30635
4.9	0					
0	1					
0	5					

	wi	Rp	VarP	SigmaP	ratio
-0.37867	1 0.3935		5 39.86213	6.313646	0.791935
0.085259	2 0.43703				
-0.07916	3 -0.65518				
0.040381	4 -0.04433				
0.175762	5 0.036015				
0.333946	6 0.415334				
-0.17751	7 0.417629				
0.921531	lambda1 -26.0441				
-2.33151	lambda2 -10.736				





-0.77333 -1.1224 1.235036

-204.776 -52.7736 9.238319

-1.70094 -2.89267 -0.5433

82.38249 33.86451 -123.312

106.6853 13.33649 -142.966

521.1259 -18.4013 -497.027

-18.4013 113.0031 -103.134

-497.027 -103.134 876.446

0.036015 0.415334 0.417629

1.755887 3.595548 0.57518

0.779106 10.52776 -1.80691

-8.64797 -28.2459 -93.9892

-0.95644 -0.95001 -9.30635

1.130259 -0.31711 7.827232

-0.31711 15.47344 12.90509

7.827232 12.90509 100.2183

Risky portfolio	A	B	C	D
$\bar{r}_p$	6.20%	4%	7.50%	8.40%
$\sigma_p$	14.50%	9.70%	17%	20%

$r_f$

0.035

	1	2	3	4	5
$r_f$	0.2	0.4	0.5	0.6	0.8
<b>Portfolio</b>	0.8	0.6	0.5	0.4	0.2

Rp

A	0.0566	0.0512	0.0485	0.0458	0.0404
B	0.039	0.038	0.0375	0.037	0.036
C	0.067	0.059	0.055	0.051	0.043
D	0.0742	0.0644	0.0595	0.0546	0.0448

VarP

A	0.013456	0.007569	0.005256	0.003364	0.000841
B	0.006022	0.003387	0.002352	0.001505	0.000376
C	0.018496	0.010404	0.007225	0.004624	0.001156
D	0.0256	0.0144	0.01	0.0064	0.0016

SigmaP

A	0.116	0.087	0.0725	0.058	0.029
B	0.0776	0.0582	0.0485	0.0388	0.0194
C	0.136	0.102	0.085	0.068	0.034
D	0.16	0.12	0.1	0.08	0.04

ratio

	0.487931	0.588506	0.668966	0.789655	1.393103
	0.502577	0.652921	0.773196	0.953608	1.85567
	0.492647	0.578431	0.647059	0.75	1.264706
	0.46375	0.536667	0.595	0.6825	1.12