

Market	Security	r_i	risk	<u>Correlation_{A,B}</u>
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 CovarMatrix

0.09	0.0144
0.0144	0.1024

Syst.Mat

0.18	0.0288	1
0.0288	0.2048	1
1	1	0

VRS

0
0
1

InvMatrix

3.056235	-3.056235	0.537897311
-3.056235	3.056235	0.462102689
0.537897	0.462103	-0.110130073
1.00	0.00	0.00
0.00	1.00	0.00
0.00	0.00	1.00

wi

0.537897
0.462103
-0.11013

proof 1

$$A \cdot A^{-1} = E$$

1	1.11E-16	0
0	1	-1.38778E-17
0	0	1

Market II CovarMatrix

0.0841	-0.005742
-0.005742	0.1089

Syst.Mat

0.1682	-0.011484	1
-0.011484	0.2178	1
1	1	0

VRS

0
0
1

InvMatrix

2.445179	-2.445179	0.560640441
-2.445179	2.445179	0.439359559
0.56064	0.43936	-0.089254117

wi

0.56064
0.43936
-0.08925

proof 1

Market III CovarMatrix

0.04	0.00684
0.00684	0.1444

<u>Syst.Mat</u>	0.08	0.01368	1
	0.01368	0.2888	1
	1	1	0

<u>VRS</u>	
	0
	0
	1

InvMatrix

2.928772	-2.928772	0.805763824
-2.928772	2.928772	0.194236176
0.805764	0.194236	-0.067118257

<u>wi</u>	
0.805764	
0.194236	
-0.06712	

proof 1

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

<u>Rp</u>	<u>VarP</u>	<u>SigmP</u>
0.261589	0.055065	0.234659

<u>Rp</u>	<u>VarP</u>	<u>SigmP</u>
0.295149	0.044627	0.211251

<u>Rp</u>	<u>VarP</u>	<u>SigmP</u>
0.224674	0.033559	0.183192

	Company 1	Company 2	Company 3	Correlation	
μ	0.8	0.3	0.6	$\sigma_{1,2}$	-0.1
σ	1.2	0.8	1.1	$\sigma_{1,3}$	-0.5
				$\sigma_{2,3}$	0.3

CovarMatrix

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

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

vrs

0
0
0
1

InvM

0.222691	-0.25436	0.031669	0.351616
-0.25436	0.668746	-0.41439	0.313964
0.031669	-0.41439	0.382718	0.33442
0.351616	0.313964	0.33442	-0.51094

wi

0.351616
0.313964
0.33442
-0.51094

proof

1

E(Rp)=50%

SystMatrix.

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

0.5

InvM

0.076093	0.050729	-0.12682	-0.34729	1.213095
0.050729	0.033819	-0.08455	1.768474	-2.5246
-0.12682	-0.08455	0.21137	-0.42118	1.311509
-0.34729	1.768474	-0.42118	-3.84297	5.783435
1.213095	-2.5246	1.311509	5.783435	-10.0384

wi

0.259258
0.506172
0.23457
-0.95125
0.76426

proof

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

Rp	VarP	SigmaP	ratio
0.576134	0.255469	0.505439	1.139868

0.576134 0.255469
 $w^t * C * w$

$C * w = A$
0.255469
0.255469
0.255469

$w^t * A$
0.255469

Rp	VarP	SigmaP	ratio
0.5	0.284562	0.533443	0.937307

0.259258 0.506172 0.23457

0.096789 -0.0126 -0.04014
-0.0126 0.163974 0.031345
-0.04014 0.031345 0.066578

	Sec ₁	Sec ₂	Sec ₃	Sec ₄	Sec ₅	Sec ₆
Sec ₁	80.5	82.7	85.3	85.1	123.9	22
Sec ₂	82.7	184.7	131.5	69.4	49.5	58
Sec ₃	85.3	131.5	374.2	384.5	366.5	103.8
Sec ₄	85.1	69.4	384.5	684.8	599.1	51.6
Sec ₅	123.9	49.5	366.5	599.1	871.4	-21.2
Sec ₆	22	58	103.8	51.6	-21.2	89.7
Sec ₇	3.5	-9.9	343.5	502.7	520.4	74.4

Minim.VariPort

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

InvM

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

Mean-variance port-E(Rp)=5%

SystMat.

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

InvM

0.016039	0.007661	-0.00407	-0.00315	-0.00914	-0.02351
0.007661	0.004685	-0.00072	-0.00131	-0.00537	-0.01269
-0.00407	-0.00072	0.004856	-0.00092	0.001708	0.002544

-0.00315	-0.00131	-0.00092	0.003579	0.001028	0.004877
-0.00914	-0.00537	0.001708	0.001028	0.00733	0.015
-0.02351	-0.01269	0.002544	0.004877	0.015	0.038551
0.016171	0.007746	-0.0034	-0.00411	-0.01055	-0.02477
2.286871	0.010736	-0.25938	-0.24623	-0.8428	-1.2544
-0.37867	0.085259	-0.07916	0.040381	0.175762	0.333946

Sec ₇	r _i (%)
3.5	1.9
-9.9	6.1
343.5	2.9
502.7	4
520.4	5.7
74.4	3.4
574.6	4.9

wi 2.1372 0.044435

		vrs		367.6936	7.853678
7	1		0	7.853678	0.36468
-19.8	1		0	-52.9898	-1.69843
687	1		0	-41.881	-0.71011
1005.4	1		0	-204.776	-1.70094
1040.8	1		0	-52.7736	-2.89267
148.8	1		0	9.238319	-0.5433
1149.2	1		0		
1	0		1		

0.045002	2.1372	w1	2.1372
0.001254	0.044435	w2	0.044435
0.002623	-0.29067	w3	-0.29067
-0.00718	-0.23027	w4	-0.23027
-0.02394	-0.77333	w5	-0.77333
-0.0502	-1.1224	w6	-1.1224
0.032436	1.235036	w7	1.235036
1.235036	-30.2875	lambda1	-30.2875

Rp 0.39525 VarP 15.14374 SigmaP 3.891496

proof 1

			vrs	
7	1	1.9		0
-19.8	1	6.1		0
687	1	2.9		0
1005.4	1	4		0
1040.8	1	5.7		0
148.8	1	3.4		0
1149.2	1	4.9		0
1	0	0		1
4.9	0	0		5

wi 0.3935 0.43703

	12.46483	14.22203	
	14.22203	35.27677	
	-21.9915	-37.6528	
	-1.48441	-1.34447	
	1.755887	0.779106	
	3.595548	10.52776	
	0.57518	-1.80691	

0.016171	2.286871	-0.37867	w1	0.3935
0.007746	0.010736	0.085259	w2	0.43703
-0.0034	-0.25938	-0.07916	w3	-0.65518

Rp 5 VarP 39.86213

-0.00411	-0.24623	0.040381	w4	-0.04433
-0.01055	-0.8428	0.175762	w5	0.036015
-0.02477	-1.2544	0.333946	w6	0.415334
0.01892	1.305199	-0.17751	w7	0.417629
1.305199	-30.6517	0.921531	lambda1	-26.0441
-0.17751	0.921531	-2.33151	lambda2	-10.736

proof

1

-0.29067 -0.23027 -0.77333 -1.1224 1.235036

-52.9898 -41.881 -204.776 -52.7736 9.238319
-1.69843 -0.71011 -1.70094 -2.89267 -0.5433
31.61554 25.73579 82.38249 33.86451 -123.312
25.73579 36.31192 106.6853 13.33649 -142.966
82.38249 106.6853 521.1259 -18.4013 -497.027
33.86451 13.33649 -18.4013 113.0031 -103.134
-123.312 -142.966 -497.027 -103.134 876.446

ratio
0.101568

-0.65518 -0.04433 0.036015 0.415334 0.417629

-21.9915 -1.48441 1.755887 3.595548 0.57518
-37.6528 -1.34447 0.779106 10.52776 -1.80691
160.6291 11.167 -8.64797 -28.2459 -93.9892
11.167 1.345623 -0.95644 -0.95001 -9.30635
-8.64797 -0.95644 1.130259 -0.31711 7.827232
-28.2459 -0.95001 -0.31711 15.47344 12.90509
-93.9892 -9.30635 7.827232 12.90509 100.2183

SigmaP ratio
6.313646 0.791935

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

rf

0.035

	1	2	3	4	5
r_f	0.2	0.4	0.5	0.6	0.8
Portfolio	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

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

ratios

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