

**Computer Problem**

Equilibrium	bar R	beta	sigma^2_ei	sigma_ei	sigma_p^2	sigma_i	bar R - Rf	ones	
*	1	25,1%	2	0,002	4,47%	0,162	40,25%	20%	1
*	2	19,8%	1,5	0,003	5,48%	0,093	30,50%	15%	1
*	3	17,0%	1,2	0,004	6,32%	0,0616	24,82%	12%	1
*	4	14,8%	1	0,005	7,07%	0,045	21,21%	10%	1
*	5	12,8%	0,8	0,006	7,75%	0,0316	17,78%	8%	1
*	6	12,0%	0,7	0,007	8,37%	0,0266	16,31%	7%	1

sigma_M^2	0,04
sigma_M	20,00%
R_f	5,00%

Rbar\_m      15%      Rbar\_m-Rf      10,00%

**1.**

Rbar	V	1	2	3	4	5	6
25%		0,162	0,12	0,096	0,08	0,064	0,056
20%		0,12	0,093	0,072	0,06	0,048	0,042
17%		0,096	0,072	0,0516	0,048	0,0384	0,0336
15%		0,08	0,06	0,048	0,045	0,032	0,028
13%		0,064	0,048	0,0384	0,032	0,024	0,0224
12%		0,056	0,042	0,0336	0,028	0,0224	0,0206

V^-1

1	2	3	4	5	6
215,235	-142,383	-85,430	-56,953	-37,969	-28,477
-142,383	162,142	-42,715	-28,477	-18,984	-14,238
-85,430	-42,715	224,371	-17,086	-11,391	-8,543
-56,953	-28,477	-17,086	188,609	-7,594	-5,695
-37,969	-18,984	-11,391	-7,594	161,604	-3,797
-28,477	-14,238	-8,543	-5,695	-3,797	140,009

**2. Tangent portfolio**

**(a)**

Z	X	125,84%	X_lintner	58,14% =>	T	0,46201747
-0,2157886		-19,37%		-8,95%	riskless	0,53798253
0,27052682		24,29%		11,22%		
-0,2196488		-19,72%		-9,11%		
-0,2130992		-19,13%		-8,84%		
0,09017561		8,10%		3,74%		
sum z	1,11392185	Rbar T	27,48%	Rbar Lintner	15,39%	
sum  z	2,409951	sigma^2 T	0,201837542	sigma^2 Lintn	0,04308427	
		sigma_T	44,93%	sigma_Lint	20,76%	
		SR_T	0,5004	SR_Lint	0,500	

**Envelop hyperbola**

A=1' V^-1 1      172,512261  
 B= 1' V^-1 bar R      9,73953488  
 C=bar R' V^-1 bar R      0,79311728

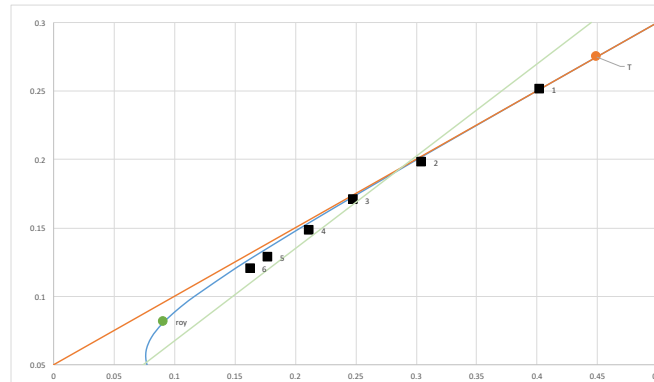
AC-B^2      41,9639145

sigma^2\_p =      4,110966833      bar R\_p^2      -      0,464186194      bar R\_p      +      0,01889998      (general formula)

**Graphical representation**

bar R	hyperbola	EF	basic assets vol	25% line	full hyperbola (no short)	hyperbola seg (no sh/hyperbola 3 as EF (3 assets))
0%	13,748%			0,00%	16,42%	16,90%
1%	12,112%			1,48%	14,83%	15,30%
2%	10,612%			2,97%	13,38%	13,83%
3%	9,314%			4,45%	12,10%	12,53%
4%	8,313%			5,93%	11,07%	11,47%
5%	7,725%	0,000%		7,41%	10,36%	10,71%
6%	7,647%	1,998%		8,90%	10,03%	10,33%
7%	8,094%	3,996%		10,38%	10,12%	10,35%
8%	8,986%	5,995%		11,86%	10,62%	10,79%
9%	10,209%	7,993%		13,34%	11,48%	11,59%
10%	11,658%	9,991%		14,83%	12,63%	12,69%
12,0%	14,965%	13,988%		17,79%	15,50%	15,51%
12,25%	15,405%	14,489%	16,31%	18,16%	15,90%	15,90%
12,8%	16,382%	15,586%	17,78%	18,98%	16,80%	16,79%
14,8%	20,062%	19,583%	21,21%	21,94%	20,28%	20,25%
15%	20,437%	19,982%		22,24%	20,64%	20,61%
16%	22,332%	21,980%		23,72%	22,47%	22,44%
17,0%	24,248%	23,979%	24,82%	25,20%	24,34%	24,31%
18%	26,180%	25,977%		26,69%	26,24%	26,21%
19%	28,127%	27,975%		28,17%	28,17%	28,14%
19,8%	29,691%	29,574%	30,50%	29,72%	29,72%	29,70%
21%	32,049%	31,972%		31,13%	32,08%	32,06%
22%	34,022%	33,970%		32,62%	34,05%	34,04%
23%	36,822%	36,795%		34,71%	36,86%	36,86%
24%	37,985%	37,966%		35,58%	38,03%	38,03%
25,00%	39,974%	39,964%		37,07%	40,03%	40,04%
25,1%	40,173%	40,164%	40,25%	37,21%	40,23%	40,23%
27%	43,961%	43,961%		40,03%	44,05%	44,09%
27,48%	44,926%	44,926%		40,75%	45,03%	45,07%
29%	47,960%	47,957%		43,00%	48,10%	48,15%
30%	49,963%	49,956%		44,48%	50,12%	50,19%

Answer: none of the basic assets is efficient.



3.

(a)  $\Pr(R_T \leq 0\%) = 0$   
 $(0\% - \bar{R}_T) / \sigma_T = -0,6117375$   
 Prob = 27,04%  $\Rightarrow$  likelihood that the tangent portfolio has negative returns

(b) Roy portfolio for  $R_L = 0\%$

Z	-5,39701	X_Roy	-55,41%
	0,55149502		5,66%
	3,23089701		33,17%
	3,42059801		35,12%
	3,88039867		39,84%
	4,05315615		41,62%
sum z	9,73953488		1

Rbar_roy	8,14%	slope alpha	25%
sigma^2_roy	0,008361053	-normsin(.)	0,67448975
sigma_roy	9,14%		
slope_roy	0,8906		
$(0\% - \bar{R}_T) / \sigma_T =$	-0,89057132		
Prob	18,66%		

4.

CAPM equilibrium

Rbar*	25,00%	Rbar	25,1%
	20,00%		19,8%
	17,00%		17,0%
	15,00%		14,8%
	13,00%		12,8%
	12,00%		12,0%

Only assets 3 and 6 are in equilibrium.  
 Asset 1 is underpriced.  $\Rightarrow$  we can use only assets 1, 3 and 6  
 Assets 2 and 4 are overpriced.

Envelop hyperbola (only assets 1, 3 and 6), shortselling allowed

Rbar		Rbar - Rf	V				
1	25,1%	20,10%		1	0,162	0,096	0,056
3	17,0%	12,00%		3	0,096	0,0616	0,0336
6	12,0%	7,00%		6	0,056	0,0336	0,0266
F	5,00%						

A = 1' V^-1 1 = 94,4864708  
 B = 1' V^-1 bar R = 6,07972069  
 C = bar R' V^-1 bar R = 0,62133939  
 AC - B^2 = 21,74516293

$\sigma^2_p = 4,345171892 \bar{R}_p^2 - 0,559179134 \bar{R}_p + 0,02857368$

<b>Mr.CAPM portfolio</b>			<b>tangent portfolio</b>		
X	beta	conditions	Z	X_T	
1	63,68%	2 Rbar_capm 19,28%	1,110997963		81,97%
3	10,42%	1,2 sigma^2_capm 0,08172285	0,183299389		13,52%
6	3,31%	sigma_capm 28,59%	0,061099796		4,51%
F	22,59%	0 SR_capm 0,49958324	sum z	1,355397149	1
		beta_capm 1,42			Rbar T 23,41%
sum x risky	0,77407143	Prob(R_capm < 0%) 25,00%			sigma^2_T 0,13585723
					sigma_T 36,86%
					SR_T 0,4996

