

Group IV

	bar R	sigma		rho		Rf 1	bar R - Rf	Rf 2	bar R - Rf2
A	15%	10%		1	0,5	3%	12%	7%	8%
B	10%	6%		0,5	1	3%	7%	7%	3%
C	20%	15%		0	0,25	3%	17%	7%	13%

1.

(a)

V	10%	6%	15%	V^-1	Ones		
10%	0,01	0,003	0	136,3636	-121,212	12,12121	1
6%	0,003	0,0036	0,00225	-121,212	404,0404	-40,404	1
15%	0	0,00225	0,0225	12,12121	-40,404	48,48485	1

(b)

Tangent Portfolio 1 (T1)				Rf1 =	3%	Tangent Portfolio 2 (T2)				Rf2 =	7%
Z	9,939394	X_T	41,98%	Z	8,848485	X_T2	73,24%				
	6,868687		29,01%		-2,82828		-23,41%				
	6,868687		29,01%		6,060606		50,17%				
sum z	23,67677		1	sum	12,08081		1				
bar R	sigma^2	sigma	SR T1	bar R_T2	sigma^2_T2	sigma_T2	SLOPE T2				
15,00%	0,005068	7,12%	1,68558955	18,68%	0,009667	9,83%	1,179454				

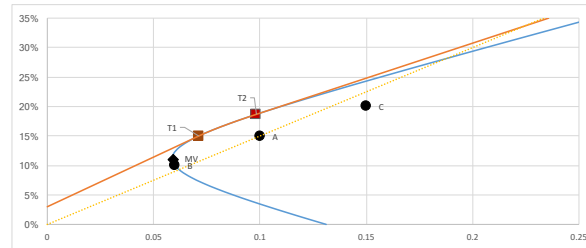
Envelop Hyperbola

$A = 1 \cdot V^{-1} \cdot 1 = 289,899$
 $B = 1 \cdot V^{-1} \cdot \text{bar R} = 32,37374$
 $C = \text{bar R} \cdot V^{-1} \cdot \text{bar R} = 4,522727$
 $AC \cdot B^2 = 263,0752$

$\sigma^2_p = 1,10196246 \cdot \text{bar R}_p^2 - 0,246118 \cdot \text{bar R}_p + 0,017192$ (general formula)

Graphical Representation

bar R	sigma^2	sigma	Hyper EF hyper	sigma line 1	sigma line 2	Telser line	line 2 (no st sigma hype EF hyper (n CCM hyper		
0,00%	0,017192	13,11%				0,00%	15,88%		
1,00%	0,014841	12,18%				0,67%	14,65%		
2,00%	0,01271	11,27%				1,33%	13,44%		
3,00%	0,0108	10,39%		0,00%		2,00%	12,26%		
4,00%	0,00911	9,54%		0,59%		2,67%	11,10%		
5,00%	0,007641	8,74%		1,19%		3,33%	9,98%		
6,00%	0,006392	7,99%		1,78%		4,00%	8,92%		
7,00%	0,005363	7,32%		2,37%		4,67%	7,94%		
8,00%	0,004555	6,75%		2,97%		5,33%	7,07%		
9,00%	0,003967	6,30%		3,56%		6,00%	6,36%		
10,00%	0,0036	6,00%		4,15%		6,67%	5,86%		
11,00%	0,003453	5,88%		4,75%		7,33%	5,63%		
12,00%	0,003526	5,94%		5,34%		8,00%	5,71%		
13,00%	0,00382	6,18%		5,93%		8,67%	6,08%		
14,00%	0,004334	6,58%		6,53%		9,33%	6,69%		
A, T1:	15,00%	0,005068	7,12%	7,12%		10,00%	7,12%	7,49%	
	16,00%	0,006023	7,76%	7,76%		10,67%	7,76%	8,42%	
T2 (no short):	17,10%	0,007324	8,56%	8,56%		11,40%	0,085606	8,56%	9,55%
	18,00%	0,008594	9,27%	9,27%		12,00%	0,093264		10,54%
T2:	18,68%	0,009667	9,83%	9,83%		12,45%	0,09902		11,30%
C:	20,00%	0,012047	10,98%	10,94%		13,33%	0,110221		12,85%
	22,50%	0,017602	13,27%	13,05%		15,00%	0,131417		15,88%
	25,00%	0,024535	15,66%	15,15%		16,67%	0,152613		19,00%
	27,50%	0,032845	18,12%	17,26%		18,33%	0,173809		22,17%
	30,00%	0,042533	20,62%	19,36%		20,00%	0,195006		25,38%
	32,50%	0,053598	23,15%	21,47%		21,67%	0,216202		28,60%
	35,00%	0,066041	25,70%	23,57%		23,33%	0,237398		31,85%



(c)

None of the basic assets A,B,C is efficient anymore.

bar R	sigma
Asset B	10% 6%

Risk level of an asset with the same expected return that belongs to hyperbola

sigma^2	0,0036
sigma	0,059997 => verify B is close but does not belong to the hyperbola => even if it would belong it would not be efficient

2.

(a) $R_L = 0\%$ $\alpha =$ $\text{Prob}(R_A < 0\%)$)

First we compute alpha

$\text{Prob}(R_A < 0\%) = 6,681\%$

$\text{Prob}(R_p < 0\%) \leq 6,681\%$

$R_p \Rightarrow 0\% - 1,5000 \sigma_p$

(b) All portfolios that satisfy this have

$R_p \geq 0\% + 1,5 \sigma_p$

EF line 2: $R_p = 7\% + 1,1794537 \sigma_p$

crossing point
 $\sigma_p = 21,838\%$

All portfolios is a volatility less or equal to 21,838%

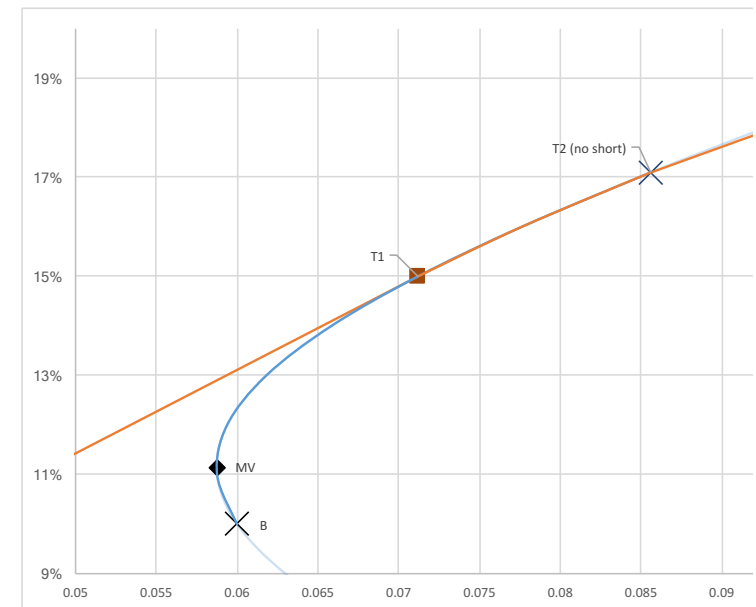
3.

Shortselling restrictions

X_{T2} (no sh)	X_{min} Slope
0,580645	0
0	1,000001
0,419355	0
1	1,000001

$R_{bar T2}$	$\sigma^2 T2$	$\sigma T2$	SLOPE
17,10%	0,007328	8,56%	1,17945373 => max slope (solver solution)
10,00%	0,0036	6,00%	0,50000117 => min slope (solver solution)

OBS: same hyperbola as before by with ending points at min and max slope (X in picture)
previous T2 not feasible



4.

CCM	corr	1	0,25	0,25
average correlation		0,25	1	0,25
	0,25	0,25	0,25	1
V (CCM)	10%	6%	15%	
10%	0,01000	0,00150	0,00375	111,1111
6%	0,00150	0,00360	0,00225	-37,037
15%	0,00375	0,00225	0,02250	308,642
				-14,8148
				-24,6914
				49,38272

CCM Tangent Portfolio 1 (T1)

Z	8,222222	X T1 (CCM)	31,53%
	12,96296		49,72%
	4,888889		18,75%
sum z	26,07407		100,00%

R bar T1	sigma^2 T1	sigma T1	SR T1
TRUE	13,45%	0,004035	6,35%
CCM	13,45%	0,004008	6,33%

CCM Tangent Portfolio 2 (T2)

Z	5,851852	X T2 (CCM)	43,57%
	3,08642		22,98%
	4,493827		33,46%
sum z	13,4321		100,00%

R bar T2	sigma^2 T2	sigma T2	Slope T2
TRUE	15,52%	0,005553	7,45%
CCM	15,52%	0,006346	7,97%

Envelop Hyperbola

A=1' V^-1 1	316,0494		
B= 1' V^-1 bar R	35,55556	AC-B^2	181,4358
C=bar R' V^-1 bar R	4,574074		

$\sigma^2_p = 1,74193548 \bar{R}_p^2 - 0,391935 \bar{R}_p + 0,02521$ (general formula)

OBS: The two hyperbolas are quite different, but T1 CCM is quite close to the true T1. So for investors with risk level lower 6.3%, that choose combination of deposit with T1, model risk should be relatively small.

