


Understanding Risk
To Help You Invest Soundly
Part IV



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Section 4 - Managing Investment Risk

- ❖ Correlation
- ❖ Efficient Diversification

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Risk and Return

Risk and return are related. Once we accept this we begin to focus on a more reasonable objective. We then start looking for the highest return for a given level of risk. Or conversely the lowest risk for a given return.

Since 1950 when Nobel Laureate Harry Markowitz published a very famous paper titled "Portfolio Selection" investment theory's main focus has been to make these ideas more concrete.

The key concept that Markowitz pioneered was efficient diversification.

Two tools are needed. Standard Deviation and Correlation.

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Alchemy

Can we take risky assets and combine them in a portfolio that is less risky than any one of its components?

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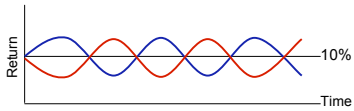
Correlation

Stock A

Return: 10%
SD: 18%

Stock B

Return: 10%
SD: 18%



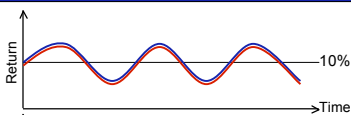
Portfolio

Return = $1/2 * 10 + 1/2 * 10 = 10\%$
Perfect Negative Correlation

Risk Eliminated!

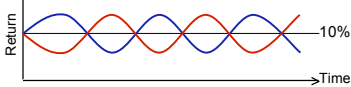
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Correlation



Correlation = 1

No risk reduction possible



Correlation = -1

All risk can be eliminated

Unrelated

Correlation = 0

Considerable risk reduction possible

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Two Asset Model - 1997 to 2008

Date	S&P 500		Emerging Markets		S&P + Emerging Markets	
	S&P	S&P Return	EM	EM Return	S&P + EM	S&P + EM Return
1/31/08	1378.55	-4.15%	1088.72	20.77%	1233.64	5.45%
1/31/07	1438.24	12.36%	901.47	15.02%	1169.86	13.37%
1/31/06	1280.08	8.36%	783.77	44.53%	1031.93	19.74%
1/31/05	1181.27	4.43%	542.28	18.61%	861.78	8.51%
1/30/04	1131.13	32.19%	457.19	57.42%	794.16	38.58%
1/31/03	855.7	-24.29%	290.43	-11.38%	573.07	-21.39%
1/31/02	1130.2	-17.26%	327.74	-13.53%	728.97	-16.45%
1/31/01	1366.01	-2.04%	379.02	-22.87%	872.52	-7.47%
1/31/00	1394.46	8.97%	491.39	67.19%	942.93	19.85%
1/29/99	1279.64	30.54%	293.91	-22.61%	786.78	15.70%
1/30/98	980.28	24.69%	379.79	-25.30%	680.04	5.06%
1/31/97	786.16		508.41		647.29	
Average Return		6.71%		11.62%		7.36%
Std. Dev		18.21%		33.61%		17.36%

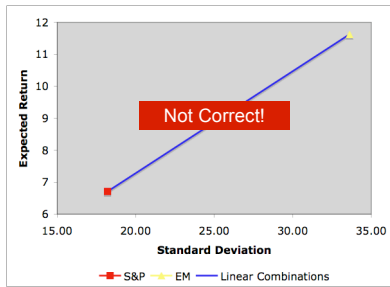
Reduced risk and improved return!

50% / 50%

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Extrapolation

Weight S&P	Weight EM	Portfolio Expected Return	Standard Deviation
100%	0%	6.71	18.21
0%	100%	11.62	33.61



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Two Asset Model - Correlation

	S&P	EM
S&P	1	
EM	0.2	1

Correlation is less than 1
ergo
some risk can be
eliminated!

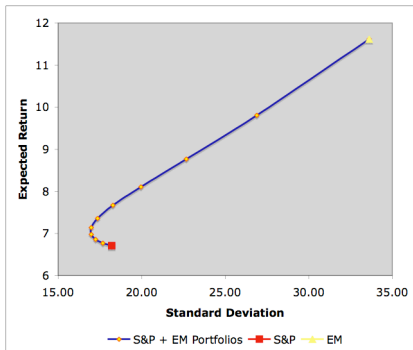
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Efficient Diversification

Weight S&P	Weight EM	Portfolio	
		Expected Return	Standard Deviation
100%	0%	6.71	18.21
90%	10%	6.77	17.67
80%	20%	6.86	17.24
70%	30%	6.98	16.98
60%	40%	7.14	16.98
50%	50%	7.36	17.36
40%	60%	7.67	18.28
30%	70%	8.11	19.96
20%	80%	8.77	22.67
10%	90%	9.81	26.89
0%	100%	11.62	33.61

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Efficient Frontier



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Economic Sectors - Performance

January 1986 to Dec 2001

Economic Sectors	Annualized Rate of Return	Annualized Standard Deviation	Return Less 2 Standard Deviations
Utility	11.5	16.4	-21.3
Consumer Cyclical	18.4	20.5	-22.6
Consumer Non-Cyclical	16.9	20.3	-23.7
Energy	13.9	19.5	-25.1
Industrial	14.2	20.7	-27.2
Basic Industry	11.7	23.0	-34.3
Financial	15.1	25.0	-34.8
Technology	13.4	31.0	-48.5

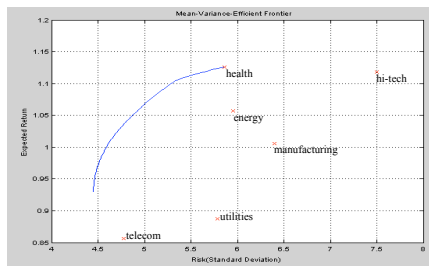
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Correlation - Economic Sectors

Economic Sectors	Utility	Consumer Cyclical	Consumer Non-Cyclical	Energy	Industrial	Basic Industry	Financial	Technology
Utility	1.0							
Consumer Cyclical	0.6	1.0						
Consumer Non-Cyclical	0.5	0.6	1.0					
Energy	0.4	0.4	0.4	1.0				
Industrial	0.5	0.6	0.8	0.6	1.0			
Basic Industry	0.4	0.5	0.7	0.6	0.8	1.0		
Financial	0.6	0.7	0.7	0.5	0.8	0.7	1.0	
Technology	0.3	0.3	0.6	0.4	0.7	0.5	0.5	1.0

Correlation - Min Variance Portfolio

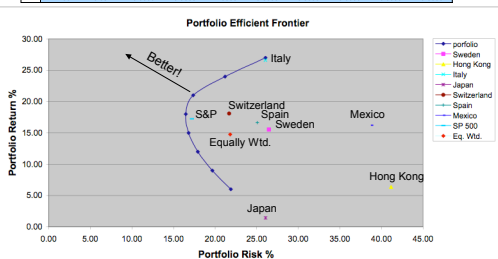
Monthly returns/variances from 1926 to 2004



	Manufacturing	Energy	Hi-tech	Telecom	Health	Utilities
Weights	-0.0000	0.2015	-0.0000	0.5911	0.1134	0.0939
SE	6.4020	5.9549	7.5021	4.7794	5.8587	5.7852

Correlation - Countries

	A	B	C	D	E	F	G	H	I	J
68	Mean	SE Low	Sweden	Hong Kong	IB	Japan	International	Spain	Mexico	S&P 500
70	6.00	21.8883	0.0185	0.0000	0.0000	0.7075	0.0000	-0.0188	0.0000	0.2571
71	9.00	19.6644	0.0217	0.0000	0.0185	0.5300	0.0176	0.0000	0.0000	0.4122
72	12.00	17.8095	0.0000	0.0000	0.2626	0.3805	0.0171	0.0000	0.0000	0.5198
73	15.00	16.8147	0.0000	0.0000	-0.1372	-0.2233	-0.0168	0.0000	0.0000	0.6209
74	18.00	16.4614	0.0000	0.0000	0.1918	0.0668	0.0164	0.0000	0.0000	0.7260
75	21.00	17.3689	0.0000	0.0000	0.4023	0.0000	0.0000	0.0000	0.0000	0.9977
76	24.00	21.1679	0.0000	0.0000	0.7225	0.0000	0.0000	0.0000	0.0000	0.2775
77	27.00	25.0514	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000



Argument for Reducing Volatility

Monte Carlo Simulation (Excel example)

Portfolio expected return and volatility

Expected Return	12%	12%	12%	12%	12%
Volatility	18%	16%	14%	12%	10%
Probability of Achieving Target	60%	65%	70%	73%	79%

Point is - reducing average volatility increases probability of achieving goal!

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The Far Side of Complexity

Efficient diversification - is the "simplicity on the far side of complexity".

Key Point - Risk can be reduced without sacrificing return by efficiently diversifying across assets which have low correlations.

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Thoughts on Efficient Diversification

1. Uncorrelated asset classes are the "holy grail".
2. Understanding "why" is more important than the math.
3. Riskier investments can actually reduce a portfolio's volatility if they are not highly correlated.
4. Reducing volatility in a portfolio increases the probability of reaching the goal.

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