Chapter 10 – Risk and Return Lessons from Market History

Calculating returns
P_0 = $45
P_1 = $53
D = $1.25

What is risk?

Standard deviation

Year	R	$R - \bar{R}$	$(R - \bar{R})^2$
1	0.10	-0.0125	0.00015625
2	0.32	0.2075	0.04305625
3	–0.08	-0.1925	0.03705625
4	0.11	-0.0025	0.00000625
Sum =	0.45		0.080275
Average =	0.1125		

Variance = $\sigma^2 = \dfrac{\sum (R - \bar{R})^2}{n - 1}$

Standard deviation = σ

Historical Risk and Return

The Normal Distribution

Return – Arithmetic or Geometric?

Year	R
1	100%
2	–50%

What was your average return?

Chapter 13 – Section 13.2 – Efficient Capital Markets

Weak, Semistrong, and Strong form efficiency

Chapter 11 – Return and Risk: The Capital Asset Pricing Model (CAPM)

Unequal Probabilities

Economy	Probability	Return	$P \times R$	$R - E(R)$	$[R - E(R)]^2$	$P[R - E(R)]^2$
Boom	0.3	0.34	0.102	0.1780000	0.0316840	0.0095052
Normal	0.5	0.14	0.07	-0.0220000	0.0004840	0.0002420
Recession	0.2	-0.05	-0.01	-0.2120000	0.0449440	0.0089888
		E(R) =	0.162		Variance =	0.0187360
					Std. Dev =	0.1368795

$\sigma^2 = \Sigma\, P[R - E(R)]^2$

Portfolios

Stock	Shares	Price	E(R)	σ	Value	w
A	100	$70	11%	47%		
B	150	$32	9%	39%		
C	220	$41	13%	61%		

Portfolio value

Portfolio weights

$E(R_P) = \sum w_i E(R_i)$

Can you find the portfolio standard deviation using a weighted average of the asset's standard deviations?

Portfolio Risk

Economy	Probability	X	Y
Bad	0.5	–20%	30%
Good	0.5	70%	10%
E(R)		25%	20%
σ		45%	10%
weight		2/11	9/11

What is the portfolio standard deviation?

Covariance

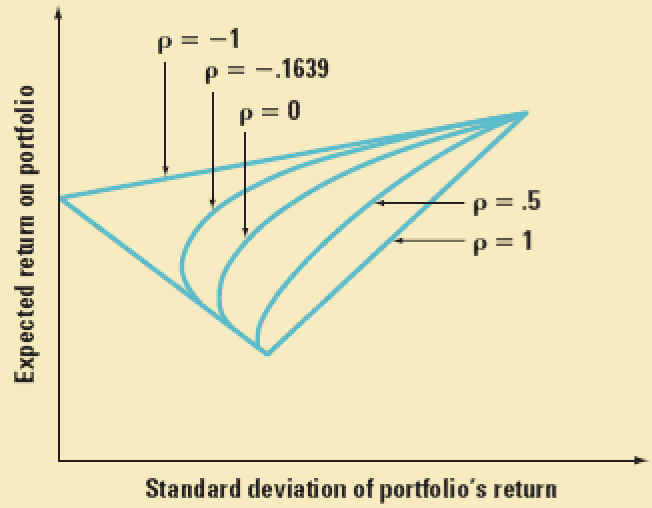
Probability	X	Y	X-E(X)	Y-E(Y)	Product of Deviations	Product
0.2	0.28	0.06	0.16	-0.034	-0.005440	-0.001088
0.7	0.11	0.10	-0.01	0.006	-0.000060	-0.000042
0.1	-0.13	0.12	-0.25	0.026	-0.006500	-0.000650
						-0.00178
E(R)	0.12	0.094				
σ^2	0.01144	0.000324				
σ	0.106958	0.018				

Correlation = $\frac{Cov(A,B)}{\sigma_A \sigma_B}$

Portfolio variance for 2 asset portfolio (total risk) = $w_A^2\sigma_A^2 + w_B^2\sigma_B^2 + 2w_A w_B Cov(A,B)$

Portfolio variance for 2 asset portfolio (total risk) = $w_A^2\sigma_A^2 + w_B^2\sigma_B^2 + 2w_A w_B \sigma_A \sigma_B \rho_{A,B}$

What does this mean in a portfolio?



Each curve represents a different correlation. The lower the correlation, the more bend in the curve.

Why does diversification work?

Actual return = Expected return + Unexpected return

Types of risk

Systematic		Unsystematic
Market	VS.	Firm specific
Nondiversifiable		Diversifiable

Systematic Risk Principle

Capital Asset Pricing Model (CAPM)

$E(R) = R_f + \beta[E(R_M) – R_f]$

$\beta = \frac{Cov(R_i R_M)}{\sigma_M^2}$

Beta of a portfolio

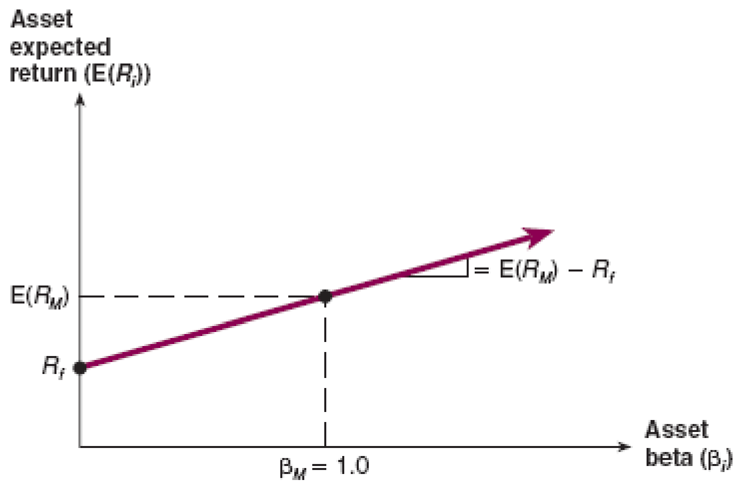
$\beta_P = \sum w_i \beta_i$

Stock	β	w
A	1.3	.25
B	.95	.45
C	1.27	

Reward-to-Risk Ratio

$$\frac{E(R) - R_f}{\beta}$$

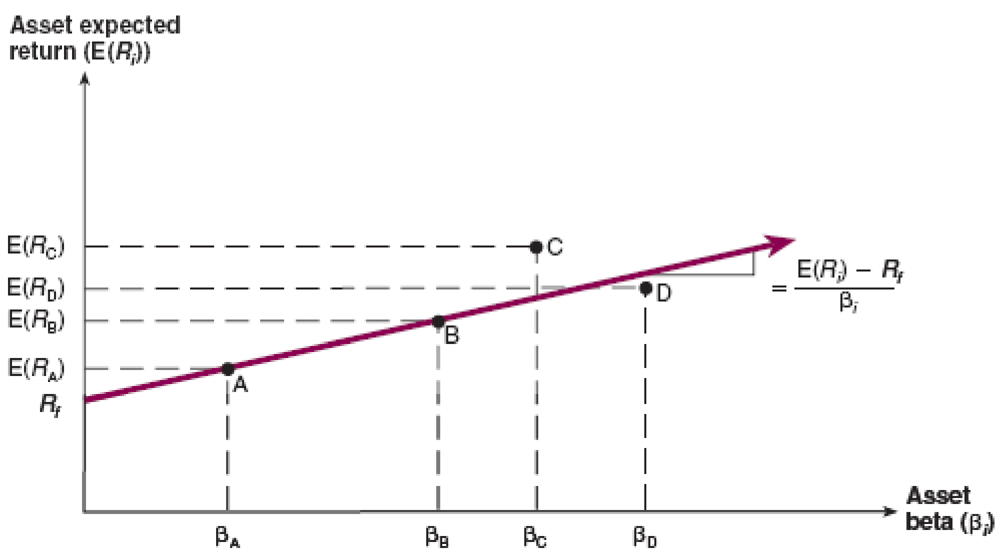
Security Market Line (SML)



The slope of the security market line is equal to the market risk premium, i.e., the reward for bearing an average amount of systematic risk. The equation describing the SML can be written:

$$E(R_i) = R_f + [E(R_M) - R_f] \times \beta_i$$

which is the capital asset pricing model, or CAPM.



The fundamental relationship between beta and expected return is that all assets must have the same reward-to-risk ratio, $[E(R_i) - R_f]/\beta_i$. This means that they would all plot on the same straight line. Assets A and B are examples of this behavior. Asset C's expected return is too high; Asset D's is too low.