Chapter 8 Notes

Principles of Risk

Some things to think about:

1. All business assets are supposed to produce cash flows. the riskier the cash flow operations, the riskier the asset.
2. Assets can be:
    1. Financial assets - Stocks, Bonds Realestate
    2. Real Assets - Trucks, machines, businesses
3. Risk can be:
    1. On a stand-alone, single stock basis - looks at the company itself and its opperations
    2. In a portfolio context - looks at risks of a whole portfolio and how their cash flows balance out for different scenarios
4. In a portfolio context, risksa can be divided into:
    1. Diversifiable risk - can be subsided with investments in other industries
    2. Market Risk - The risk of general stock market decline across all industries
5. Stocks with high market risks must offer higher rates of returns for investors
6. If investors think a stock is too risky given its return, they will sell; driving down the price and boosting the expected return / price ratio. The opposite is also true.
7. Stand-Alone risk is extremely importaint when analyzing real assets

Probability Distrobutions

Expected Rate Of Return

	A	B	C	D	E	F	G	H
16		Martin Products				U.S. Water		
17			Rate of				Rate of	
18	Economy,	Probability	Return			Probability	Return	
19	Which	of this	if this			of this	if this	
20	Affects	Demand	Demand	Product		Demand	Demand	Product
21	Demand	Occurring	Occurs	(2) × (3)		Occurring	Occurs	(5) × (6)
22	(1)	(2)	(3)	(4)		(5)	(6)	(7)
23	Strong	0.30	80%	24%		0.30	15%	4.5%
24	Normal	0.40	10%	4%		0.40	10%	4.0%
25	Weak	0.30	–60%	–18%		0.30	5%	1.5%
26		1.00	Expected return =	10%		1.00	Expected return =	10.0%
27								

- Computes and Averages the products of the probability of different market scenarios happening and the rate of return in those scenarious with different sectors of the business

- Calculating this for smaller and smaller values of Δx gives us a smooth probability distrobution
- The tighter the probability disrobution, the lower the risk

Measuring Stand Alone Risk

Using Standard Deviation To Measure Risk

- We can represent risk with the standard deviation of the probability distrobution
- σ represents the standard deviation
- The smaller σ the less risky an asset is

	A	B	C	D	E	F	G	H
33			Rate of	Deviation:				
34	Economy,	Probability	Return	Actual –				
35	Which	of this	if this	10%			Squared	
36	Affects	Demand	Demand	Expected		Deviation	Deviation	
37	Demand	Occurring	Occurs	Return		Squared	× Prob.	
38	(1)	(2)	(3)	(4)		(5)	(6)	
39	Strong	0.30	80%	70%		0.4900	0.1470	
40	Normal	0.40	10%	0%		0.0000	0.0000	
41	Weak	0.30	–60%	–70%		0.4900	0.1470	
42		1.00				Σ = Variance:	0.2940	
43			Standard deviation = square root of variance: σ =				0.5422	
44			Standard deviation expressed as a percentage: σ =				54.22%	

Using Historical Data to Measure Risk

- Can give an idea of how stocks will do in the future by looking at past years of return

	A	B	C	D	E	F	G	H
73				Deviation				
74				from				
75	Year	Return		Average			Squared Deviation	
76	(1)	(2)		(3)			(4)	
77	2015	30.0%		19.8%			0.0390	
78	2016	–10.0%		–20.3%			0.0410	
79	2017	–19.0%		–29.3%			0.0856	
80	2018	40.0%		29.8%			0.0885	
81	Average	10.3%		Sum of Squared Devs (SSDevs):			0.2541	
82				SSDevs/(N – 1) = SSDevs/3:			0.0847	
83			Standard deviation = Square root of SSDevs/3: σ =				29.10%	
84			Excel Function: STDEV(B77:B80) σ =				29.10%	

Comparing High Risk-High Reward stocks and Low Risk-Low Reward Stocks

- Coefficient of Variation
  - Standard Dev/Expected Return
  - Shows the risk per unit of return, better for comparison between two alternitives in different positions
  - $CV = \frac{\sigma}{\hat{r}}$
- Sharpe Ratio
  - Sharpe Ratio = (Return - Risk-free rate)/σ
- Expected rate of return = (Expected Ending value - Cost)/Cost
- **Risk Premium** is the aditional compensation investors require for a higher risk stock

- High Eror - Low Eror = Risk Premium

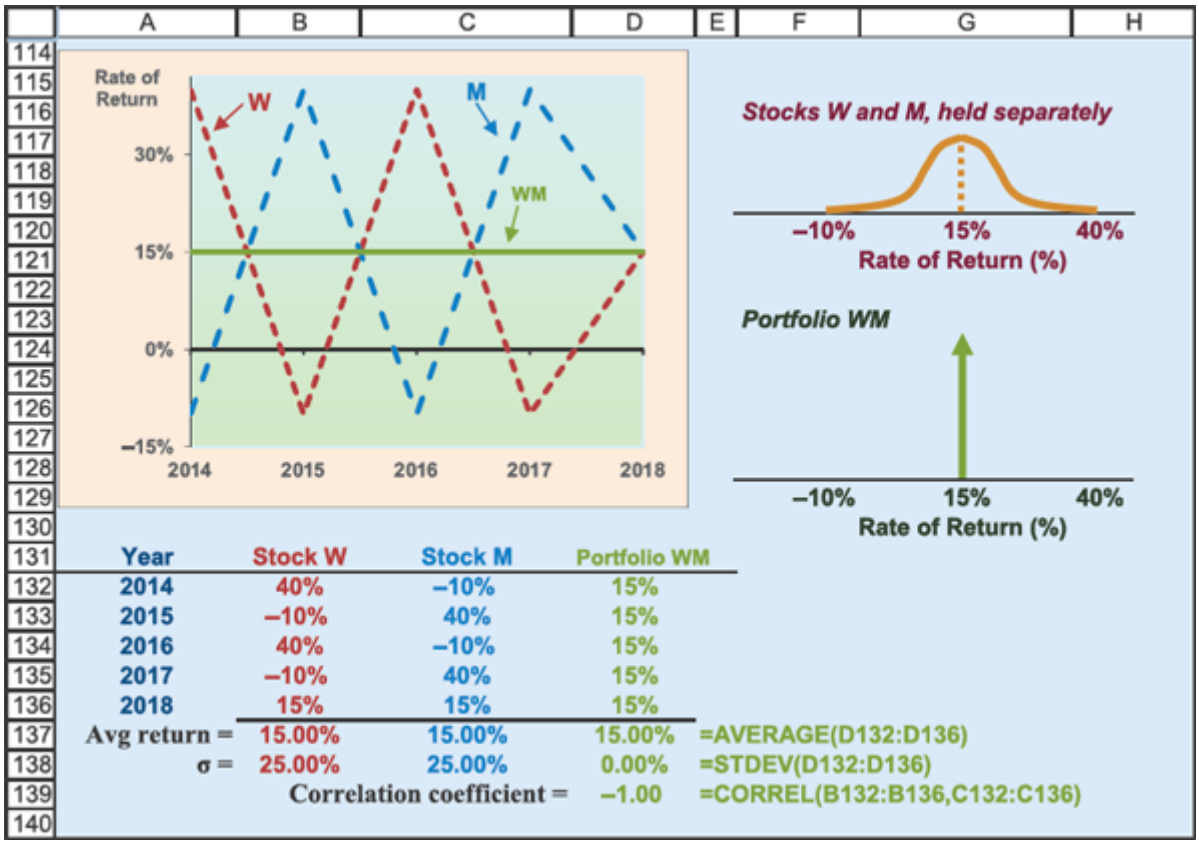
Risk in a Portolio

Capital Asset Pricing Model or CAPM Theory

- Expected return on a portfolio $\hat{r_p}$ is the weighted average of expected returns from individual assets in the portfolio
- $\hat{r_p} = w_1\hat{r_1} + w_2\hat{r_2} + \ldots + w_N\hat{r_N} = \sum_{i=1}^{N} w_i\hat{r_i}$
  - $\hat{r_i}$ = expected return on the ith stock
  - $\hat{w_i}$ = stocks weights (percentage of total value of portfolio)
  - N = number of stocks in the portfolio

	A	B	C	D	E	F	G	H
101		Expected	Dollars	Percent of		Product:		
102	Stock	Return	Invested	Total (w_i)		(2) × (4)		
103	(1)	(2)	(3)	(4)		(5)		
104	Microsoft	7.75%	$25,000	25.0%		1.9375%		
105	IBM	7.25%	$25,000	25.0%		1.8125%		
106	GE	8.75%	$25,000	25.0%		2.1875%		
107	Exxon Mobil	7.75%	$25,000	25.0%		1.9375%		
108		7.875%	$100,000	100.0%		7.875%	= Expected r_p	
109								

- Expected future values are based on analyst opinions/studies, and are subjective

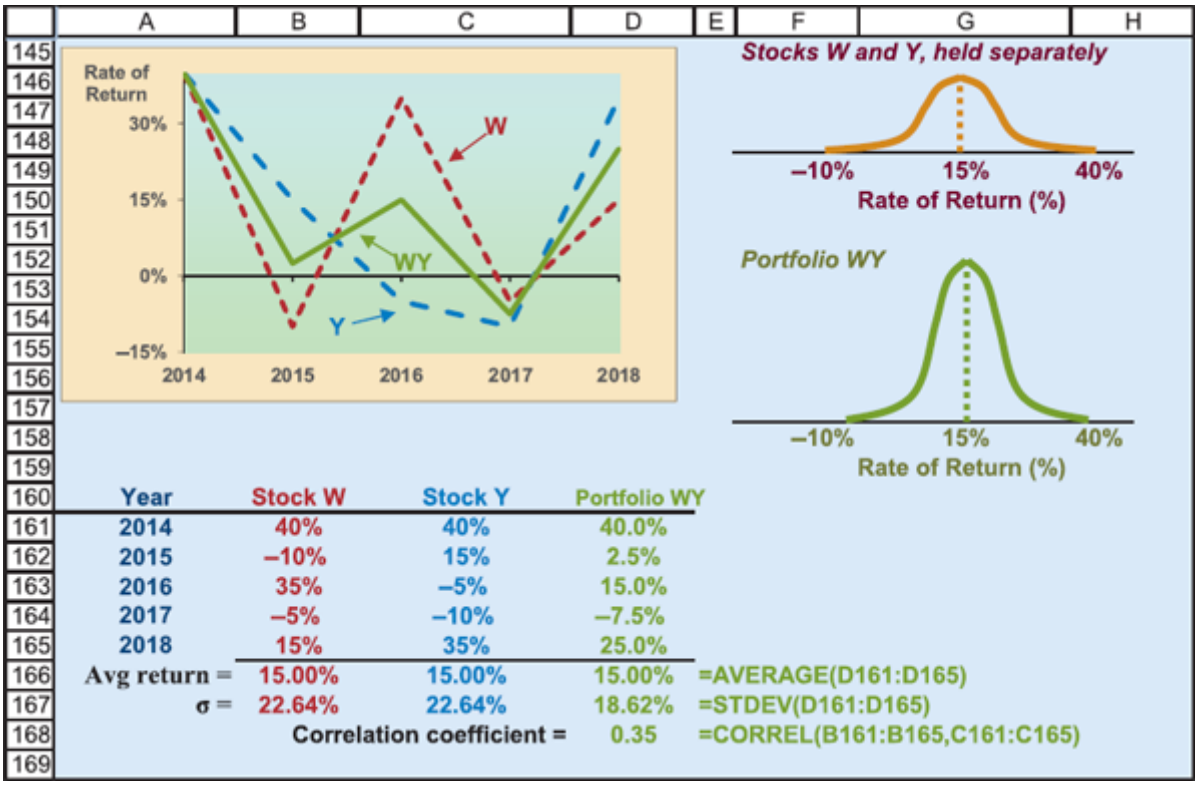


Year	Stock W	Stock M	Portfolio WM	
2014	40%	–10%	15%	
2015	–10%	40%	15%	
2016	40%	–10%	15%	
2017	–10%	40%	15%	
2018	15%	15%	15%	
Avg return =	15.00%	15.00%	15.00%	=AVERAGE(D132:D136)
σ =	25.00%	25.00%	0.00%	=STDEV(D132:D136)
	Correlation coefficient =		–1.00	=CORREL(B132:B136,C132:C136)

Correlation

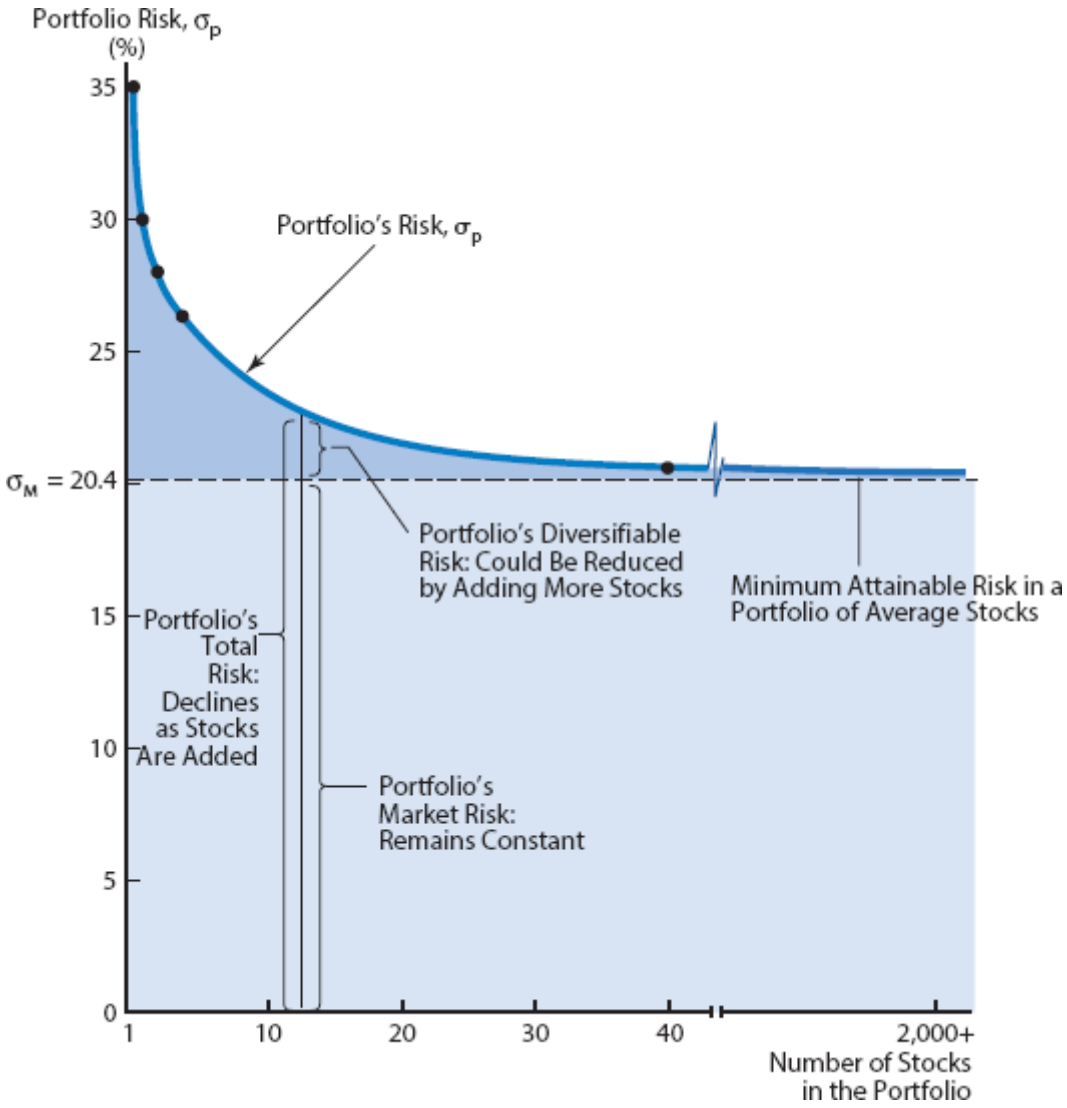
- Correlation is the tendency of stocks to move together, going up and downtogether
  - near +1 'perfectly positive correlation'

- near -1 'perfectly negatively correlated'
- near 0 'independent'
- diversification is useless for a perfectly positively coorelated portfolio

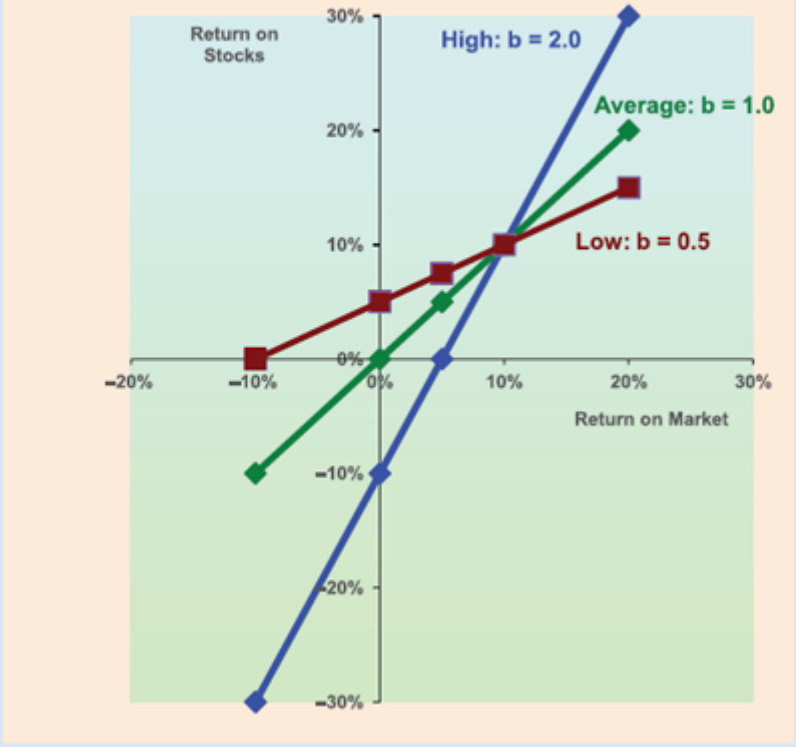


Year	Stock W	Stock Y	Portfolio WY	
2014	40%	40%	40.0%	
2015	–10%	15%	2.5%	
2016	35%	–5%	15.0%	
2017	–5%	–10%	–7.5%	
2018	15%	35%	25.0%	
Avg return =	15.00%	15.00%	15.00%	=AVERAGE(D161:D165)
σ =	22.64%	22.64%	18.62%	=STDEV(D161:D165)
Correlation coefficient =			0.35	=CORREL(B161:B165,C161:C165)

- Portfolio risk declines as number of stocks in a portfolio increases
  - Portfolio Risk declines as stocks are added up to about 40-50 stocks with diminishing rate of returns
  - Diversifiable risk can be avoided, market risk cannot (even if you hold every stock in the market)


Portfolio Risk, σ_p
(%)
35
30
25
σ_M = 20.4
15
10
5
0
Portfolio's Risk, σ_p
Portfolio's Diversifiable Risk: Could Be Reduced by Adding More Stocks
Minimum Attainable Risk in a Portfolio of Average Stocks
Portfolio's Total Risk: Declines as Stocks Are Added
Portfolio's Market Risk: Remains Constant
1
10
20
30
40
2,000+
Number of Stocks in the Portfolio

Beta's represent riskiness to the a portfolio or the market as a whole



Year	r_M	r_H	r_A	r_L
1	10.0%	10.0%	10.0%	10.0%
2	20.0%	30.0%	20.0%	15.0%
3	–10.0%	–30.0%	–10.0%	0.0%
4	0.0%	–10.0%	0.0%	5.0%
5	5.0%	0.0%	5.0%	7.5%

Calculating beta:

1. Rise-Over-Run. Divide the vertical axis change that results from a given change on the horizontal axis, i.e., the change in the stock's return divided by the change in the market return. For Stock H, when the Market rises from –10% to +20%, or by 30%, the stock's return goes from –30% to +30%, or by 60%. Thus, beta H by the rise-over-run method is 60/30 = 2.0. In the same way, we find beta A to be 1.0 and beta L to be 0.5. This procedure is easy in our example because all the points lie on a straight line, but if the points were scattered around the trend line, we could not calculate an exact beta in this manner.

2. Financial Calculator. Financial calculators have a built-in function that can be used to calculate beta. The procedure differs somewhat from calculator to calculator. See our tutorial on the textbook's student companion site at cengage.com for instructions on several calculators.

3. Excel. Excel's Slope function can be used to calculate betas. Here are the functions for our three stocks:

$Beta_H$	2.0	=SLOPE(C235:C239,B235:B239)
$Beta_A$	1.0	=SLOPE(D235:D239,B235:B239)
$Beta_L$	0.5	=SLOPE(F235:F239,B235:B239)

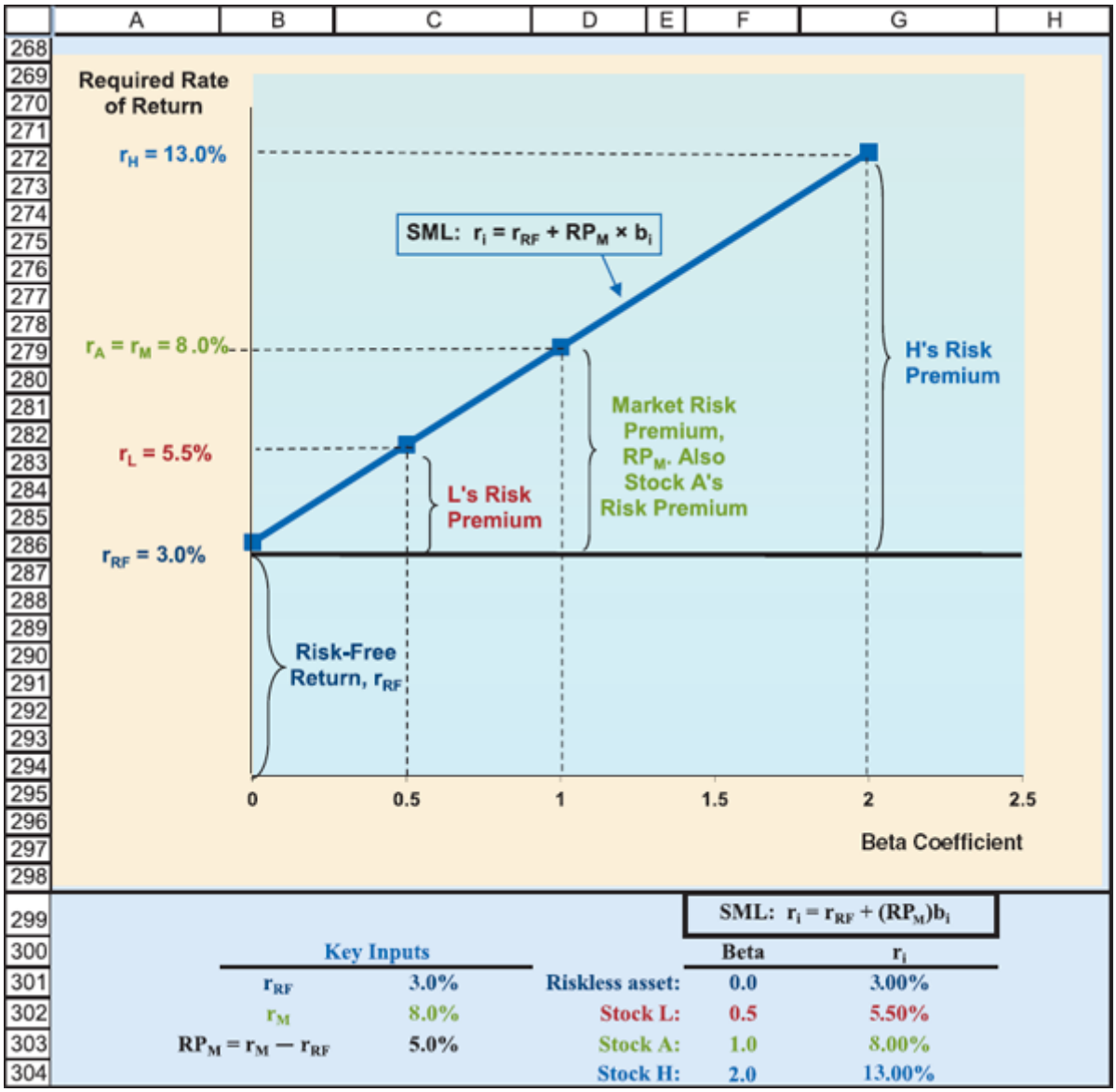
$$b_p = w_1 b_1 + w_2 b_2 + \ldots + w_N b_N = \sum_{i=1}^{N} w_i b_i$$

- beta of 1 moves with the market
- beta .5 is half as volatile as the market
- beta 2 is double as volatile as the market

Risk Premiums

- Based partially on Risk Free rate of return

    - Usually Determined by Short Term T-Bills or Long Term T-Bonds
    - The baseline for what a 'Risk-Free' investment would be
- Risk Premium Market = Return of the Market - Risk Free Return = 8% - 3% = 5%
- Risk Premium Stock RP_S= $(RP_m) * b_S$ = (5%)(.5)= 2.5%
- Security market Line Equation
- $r_S = r_{RF} + (r_M - r_{RF})b_L = r_{RF} + (RP_M)b_L$ = 3% +(8%-3%)(0.5) = 5.5%



Factoring in Inflation

$r_{RF} = r^* + IP$
where:

- r_{RF} - Rate of Risk Free Return
- r^* - real inflationfree rate of return
- IP - Inflation Premium (expected inflation)

R