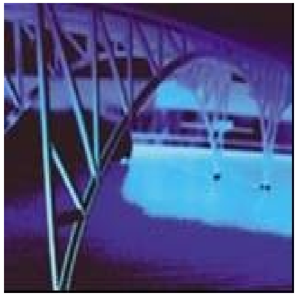
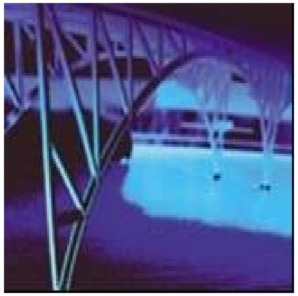
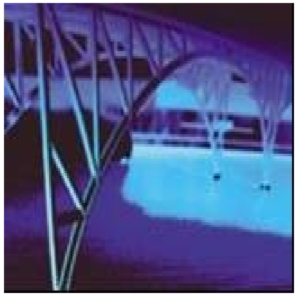


Risk and Return



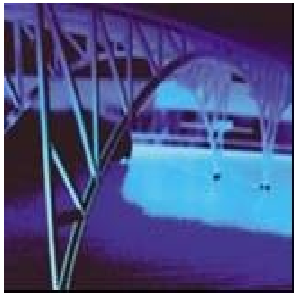
After studying Chapter 5, you should be able to:

1. Understand the relationship (or “trade-off”) between risk and return.
2. Define risk and return and show how to measure them by calculating expected return, standard deviation, and coefficient of variation.
3. Discuss the different types of investor attitudes toward risk.
4. Explain risk and return in a portfolio context, and distinguish between individual security and portfolio risk.
5. Distinguish between avoidable (unsystematic) risk and unavoidable (systematic) risk and explain how proper diversification can eliminate one of these risks.
6. Define and explain the capital-asset pricing model (CAPM), beta, and the characteristic line.
7. Calculate a required rate of return using the capital-asset pricing model (CAPM).
8. Demonstrate how the Security Market Line (SML) can be used to describe this relationship between expected rate of return and systematic risk.
9. Explain what is meant by an “efficient financial market” and describe the three levels (or forms) to market efficiency.



Risk and Return

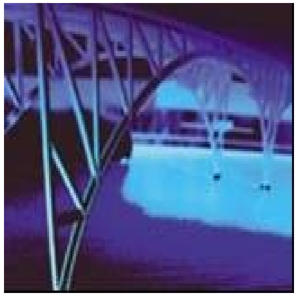
- Defining Risk and Return
- Using Probability Distributions to Measure Risk
- Attitudes Toward Risk
- Risk and Return in a Portfolio Context
- Diversification
- The Capital Asset Pricing Model (CAPM)
- Efficient Financial Markets



Defining Return

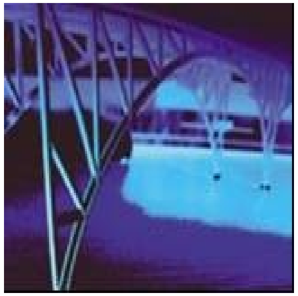
Income received on an investment plus any **change in market price**, usually expressed as a percent of the **beginning market price** of the investment.

$$R = \frac{D_t + (P_t - P_{t-1})}{P_{t-1}}$$



Return Example

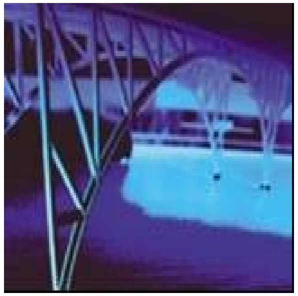
The stock price for Stock A was $10 per share 1 year ago. The stock is currently trading at $9.50 per share and shareholders just received a $1 dividend. What return was earned over the past year?



Return Example

The stock price for Stock A was $10 per share 1 year ago. The stock is currently trading at $9.50 per share and shareholders just received a $1 dividend. What return was earned over the past year?

$$R = \frac{\$1.00 + (\$9.50 - \$10.00)}{\$10.00} = 5\%$$



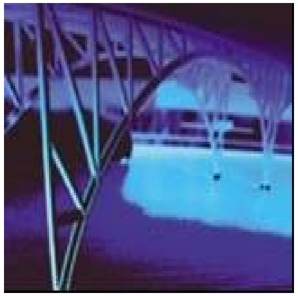
Defining Risk

The variability of returns from those that are expected.

What rate of return do you expect on your investment (savings) this year?

What rate will you actually earn?

Does it matter if it is a bank CD or a share of stock?



Determining Expected Return (Discrete Dist.)

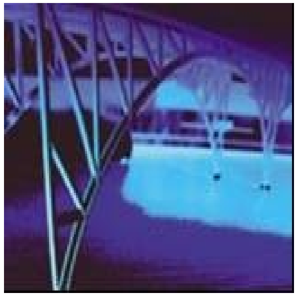
$$\bar{R} = \sum_{i=1}^{n} (R_i)(P_i)$$

$\bar{R}$ is the expected return for the asset,

R_i is the return for the i^{th} possibility,

P_i is the probability of that return occurring,

n is the total number of possibilities.

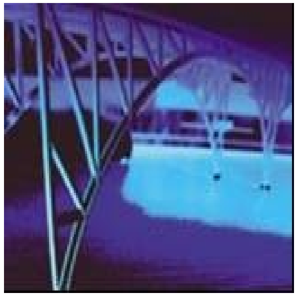


How to Determine the Expected Return and Standard Deviation

Stock BW

R_i	P_i	$(R_i)(P_i)$
-.15	.10	-.015
-.03	.20	-.006
.09	.40	.036
.21	.20	.042
.33	.10	.033
Sum	***1.00***	***.090***

The expected return, $\bar{R}$, for Stock BW is .09 or 9%



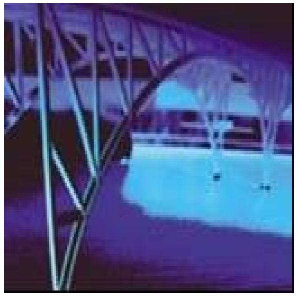
Determining Standard Deviation (Risk Measure)

$$\sigma = \sqrt{\sum_{i=1}^{n} (R_i - \bar{R})^2 (P_i)}$$

Standard Deviation, σ, is a statistical measure of the variability of a distribution around its mean.

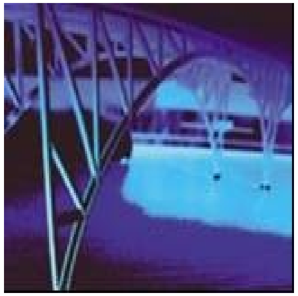
It is the square root of variance.

Note, this is for a discrete distribution.



How to Determine the Expected Return and Standard Deviation

Stock BW			
R_i	P_i	$(R_i)(P_i)$	$(R_i - \bar{R})^2(P_i)$
-.15	.10	-.015	.00576
-.03	.20	-.006	.00288
.09	.40	.036	.00000
.21	.20	.042	.00288
.33	.10	.033	.00576
Sum	*1.00*	*.090*	*.01728*

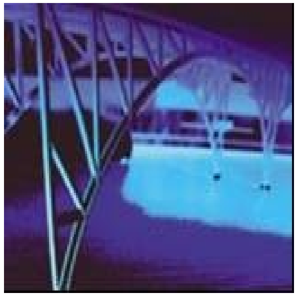


Determining Standard Deviation (Risk Measure)

$$\sigma = \sqrt{\sum_{i=1}^{n} (R_i - \bar{R})^2 (P_i)}$$

$$\sigma = \sqrt{.01728}$$

$\sigma =$ **.1315 or 13.15%**



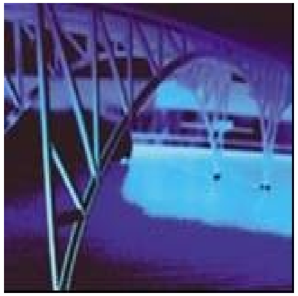
Coefficient of Variation

The ratio of the *standard deviation* of a distribution to the *mean* of that distribution.

It is a measure of ***RELATIVE*** risk.

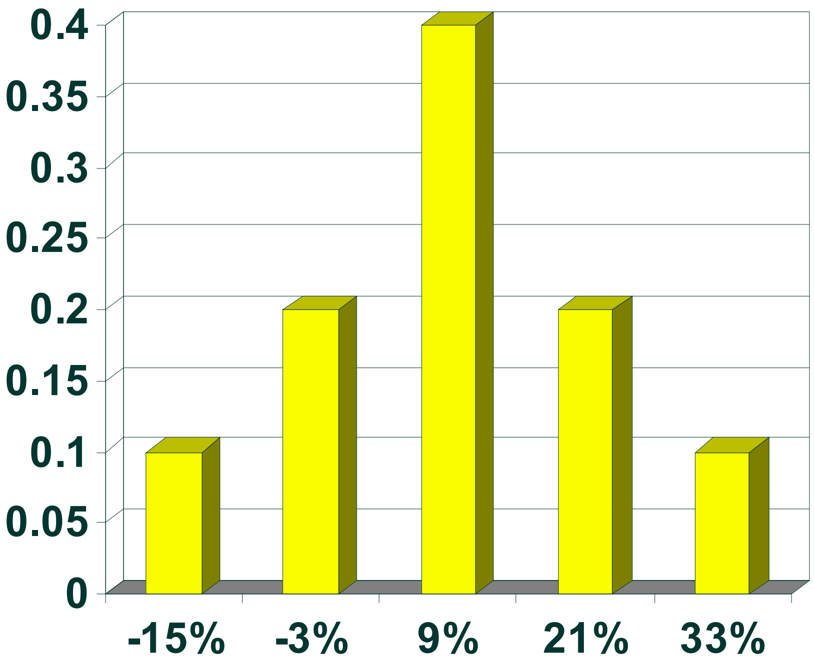
$$CV = \sigma / \bar{R}$$

CV of BW = .1315 / .09 = 1.46

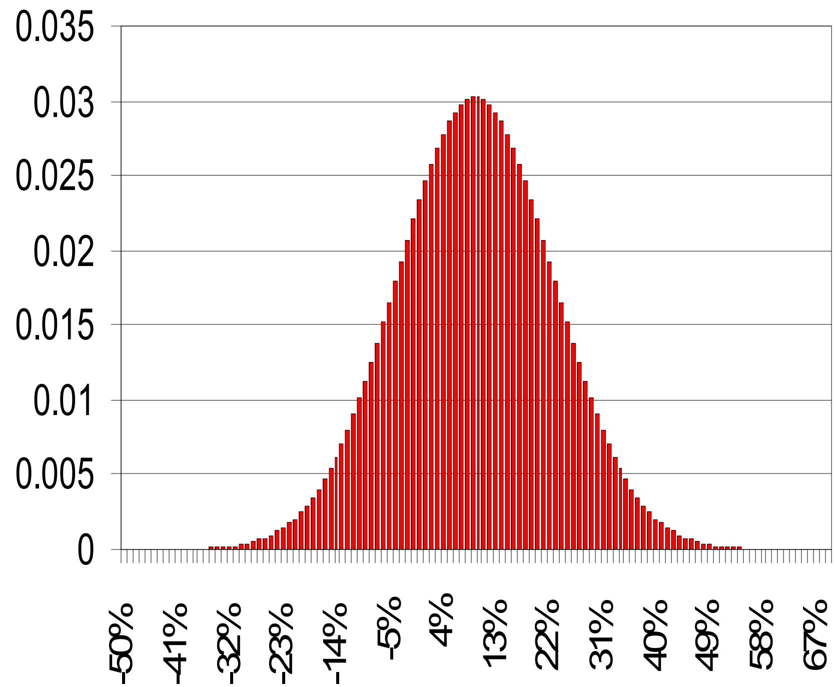


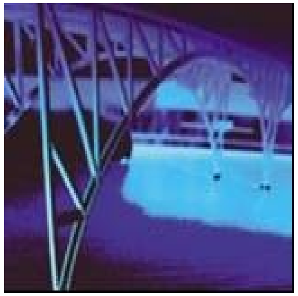
Discrete vs. Continuous Distributions

Discrete



Continuous





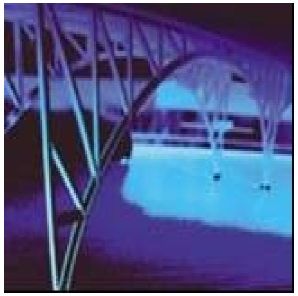
Determining Expected Return (Continuous Dist.)

$$\bar{R} = \sum_{i=1}^{n} (R_i) / (n)$$

$\bar{R}$ is the expected return for the asset,

R_i is the return for the ith observation,

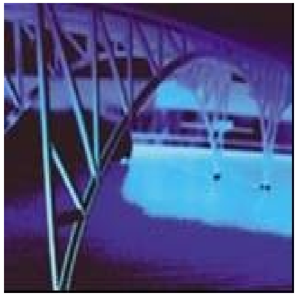
n is the total number of observations.



Determining Standard Deviation (Risk Measure)

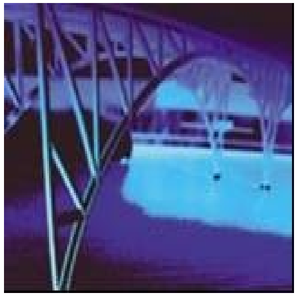
$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} (R_i - \bar{R})^2}{(n)}}$$

Note, this is for a continuous distribution where the distribution is for a *population*. $\bar{R}$ represents the population mean in this example.

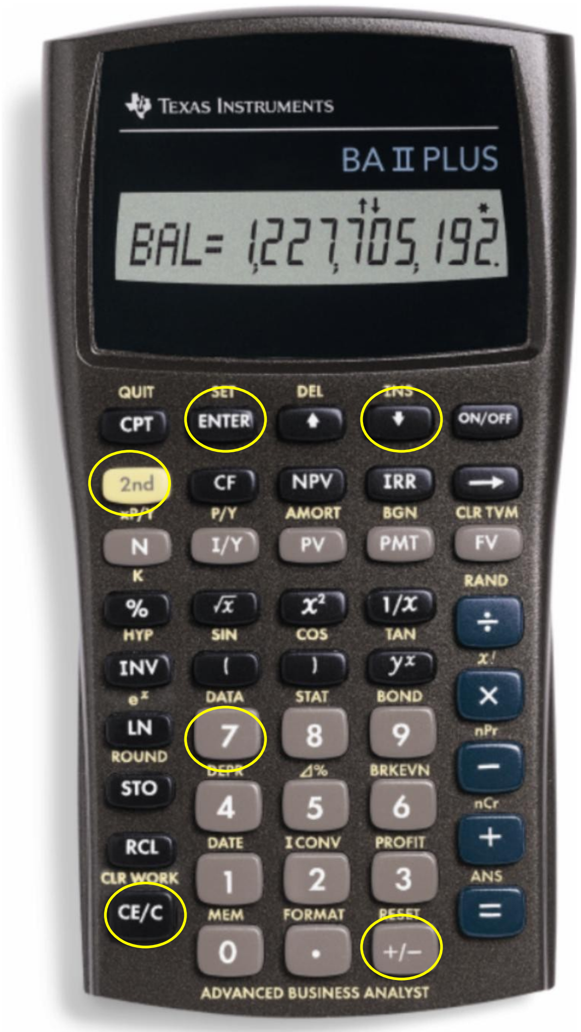


Continuous Distribution Problem

- **Assume that the following list represents the continuous distribution of population returns for a particular investment (even though there are only 10 returns).**
- 9.6%, -15.4%, 26.7%, -0.2%, 20.9%, 28.3%, -5.9%, 3.3%, 12.2%, 10.5%
- **Calculate the Expected Return and Standard Deviation for the *population* assuming a continuous distribution.**



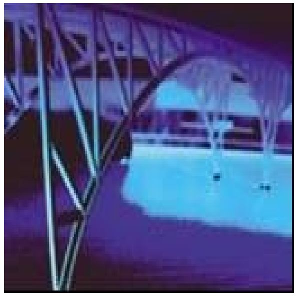
Let's Use the Calculator!



Enter "Data" first. Press:

2^{nd}	Data		
2^{nd}	CLR Work		
9.6	ENTER	↓	↓
-15.4	ENTER	↓	↓
26.7	ENTER	↓	↓

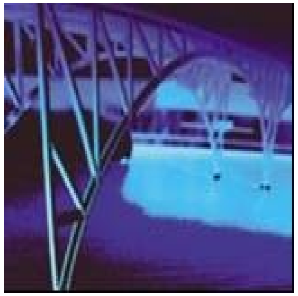
- Note, we are inputting data only for the "X" variable and ignoring entries for the "Y" variable in this case.



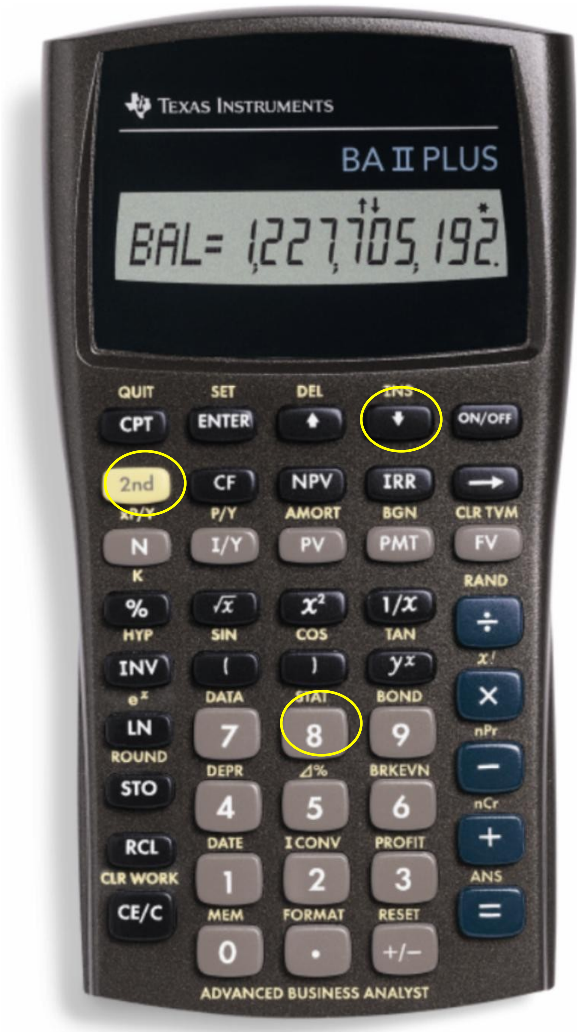
Let's Use the Calculator!

<u>Enter "Data" first. Press</u>:

-0.2	ENTER	↓	↓
20.9	ENTER	↓	↓
28.3	ENTER	↓	↓
-5.9	ENTER	↓	↓
3.3	ENTER	↓	↓
12.2	ENTER	↓	↓
10.5	ENTER	↓	↓



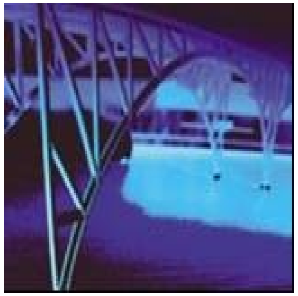
Let's Use the Calculator!



<u>Examine Results! Press</u>:

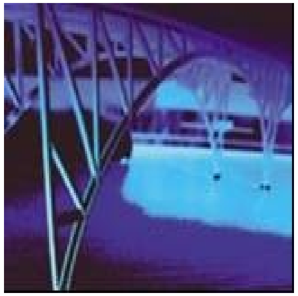
2nd **Stat**

- **↓ through the results.**
- **Expected return is 9% for the 10 observations. Population standard deviation is 13.32%.**
- **This *can* be much quicker than calculating by hand, but slower than using a spreadsheet.**



Risk Attitudes

<u>Certainty Equivalent</u> (*CE*) is the amount of cash someone would require with certainty at a point in time to make the individual indifferent between that certain amount and an amount expected to be received with risk at the same point in time.



Risk Attitudes

Certainty equivalent > Expected value

Risk Preference

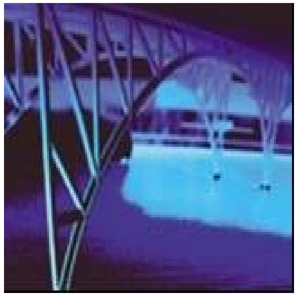
Certainty equivalent = Expected value

Risk Indifference

Certainty equivalent < Expected value

Risk Aversion

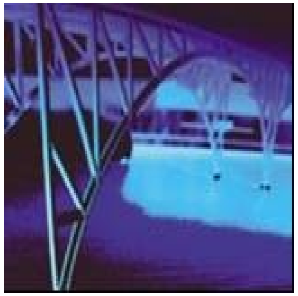
***Most* individuals are Risk Averse.**



Risk Attitude Example

You have the choice between (1) a guaranteed dollar reward or (2) a coin-flip gamble of $100,000 (50% chance) or $0 (50% chance). The expected value of the gamble is $50,000.

- Mary requires a guaranteed $25,000, or more, to call off the gamble.
- Raleigh is just as happy to take $50,000 or take the risky gamble.
- Shannon requires at least $52,000 to call off the gamble.



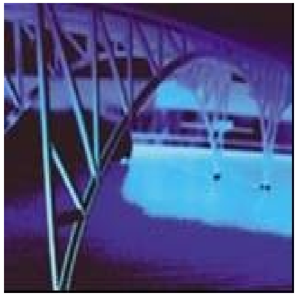
Risk Attitude Example

What are the Risk Attitude tendencies of each?

Mary shows "risk aversion" because her "certainty equivalent" < the expected value of the gamble.

Raleigh exhibits "risk indifference" because her "certainty equivalent" equals the expected value of the gamble.

Shannon reveals a "risk preference" because her "certainty equivalent" > the expected value of the gamble.



Determining Portfolio Expected Return

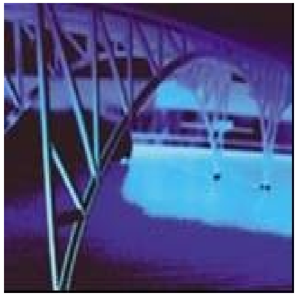
$$\bar{R}_P = \sum_{j=1}^{m} (W_j)(\bar{R}_j)$$

$\bar{R}_P$ is the expected return for the portfolio,

W_j is the weight (investment proportion) for the j^{th} asset in the portfolio,

$\bar{R}_j$ is the expected return of the j^{th} asset,

m is the total number of assets in the portfolio.



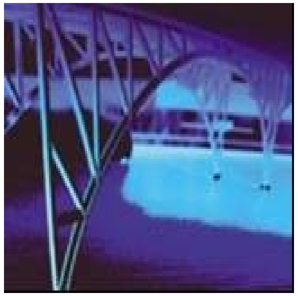
Determining Portfolio Standard Deviation

$$\sigma_P = \sqrt{\sum_{j=1}^{m} \sum_{k=1}^{m} W_j \, W_k \, \sigma_{jk}}$$

W_j is the weight (investment proportion) for the j^{th} asset in the portfolio,

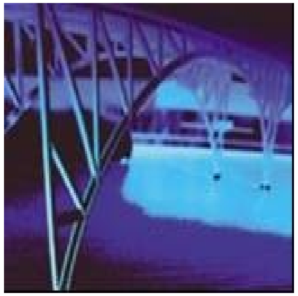
W_k is the weight (investment proportion) for the k^{th} asset in the portfolio,

σ_{jk} is the covariance between returns for the j^{th} and k^{th} assets in the portfolio.



Tip Slide: Appendix A

Slides 5-28 through 5-30 and 5-33 through 5-36 assume that the student has read Appendix A in Chapter 5



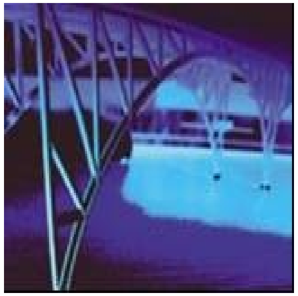
What is Covariance?

$$\sigma_{jk} = \sigma_j \sigma_k r_{jk}$$

σ_j is the standard deviation of the j^{th} asset in the portfolio,

σ_k is the standard deviation of the k^{th} asset in the portfolio,

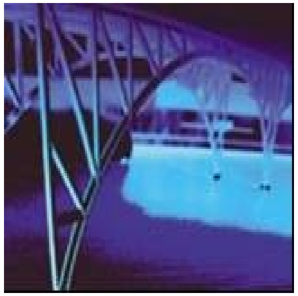
r_{jk} is the correlation coefficient between the j^{th} and k^{th} assets in the portfolio.



Correlation Coefficient

A standardized statistical measure of the linear relationship between two variables.

Its range is from *-1.0* (perfect negative correlation), through *0* (no correlation), to *+1.0* (perfect positive correlation).

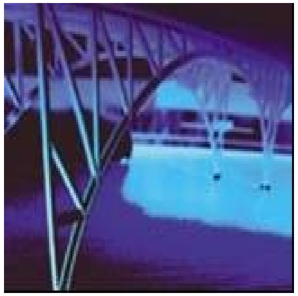


Variance - Covariance Matrix

A three asset portfolio:

	Col 1	Col 2	Col 3
Row 1	$W_1W_1\sigma_{1,1}$	$W_1W_2\sigma_{1,2}$	$W_1W_3\sigma_{1,3}$
Row 2	$W_2W_1\sigma_{2,1}$	$W_2W_2\sigma_{2,2}$	$W_2W_3\sigma_{2,3}$
Row 3	$W_3W_1\sigma_{3,1}$	$W_3W_2\sigma_{3,2}$	$W_3W_3\sigma_{3,3}$

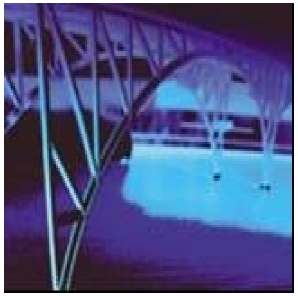
$\sigma_{j,k}$ = is the covariance between returns for the j^{th} and k^{th} assets in the portfolio.



Portfolio Risk and Expected Return Example

You are creating a portfolio of Stock D and Stock BW (from earlier). You are investing $2,000 in Stock BW and $3,000 in Stock D. Remember that the expected return and standard deviation of Stock BW is 9% and 13.15% respectively. The expected return and standard deviation of Stock D is 8% and 10.65% respectively. The correlation coefficient between BW and D is 0.75.

What is the expected return and standard deviation of the portfolio?



Determining Portfolio Expected Return

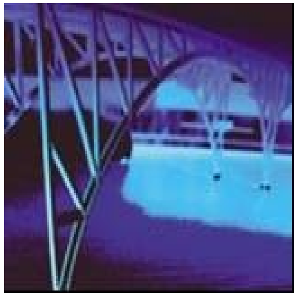
$W_{BW} = \$2,000 / \$5,000 = .4$

$W_{D} = \$3,000 / \$5,000 = .6$

$$\bar{R}_P = (W_{BW})(\bar{R}_{BW}) + (W_D)(\bar{R}_D)$$

$$\bar{R}_P = (.4)(9\%) + (.6)(8\%)$$

$$\bar{R}_P = (3.6\%) + (4.8\%) = 8.4\%$$

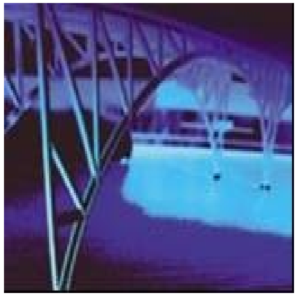


Determining Portfolio Standard Deviation

Two-asset portfolio:

	Col 1	Col 2
Row 1	$W_{BW} W_{BW} \sigma_{BW,BW}$	$W_{BW} W_{D} \sigma_{BW,D}$
Row 2	$W_{D} W_{BW} \sigma_{D,BW}$	$W_{D} W_{D} \sigma_{D,D}$

This represents the variance - covariance matrix for the two-asset portfolio.

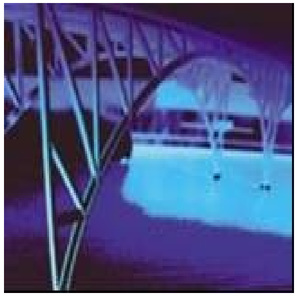


Determining Portfolio Standard Deviation

Two-asset portfolio:

	Col 1	Col 2
Row 1	(.4)(.4)(.0173)	(.4)(.6)(.0105)
Row 2	(.6)(.4)(.0105)	(.6)(.6)(.0113)

This represents substitution into the variance - covariance matrix.

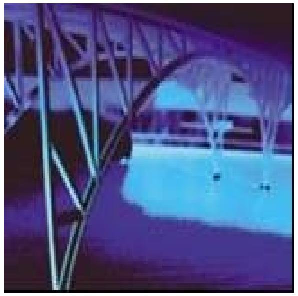


Determining Portfolio Standard Deviation

Two-asset portfolio:

	Col 1	Col 2
Row 1	(.0028)	(.0025)
Row 2	(.0025)	(.0041)

This represents the actual element values in the variance - covariance matrix.



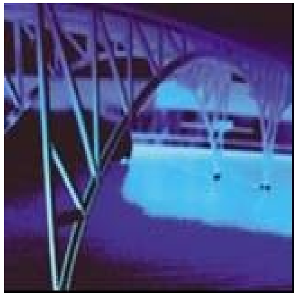
Determining Portfolio Standard Deviation

$$\sigma_P = \sqrt{.0028 + (2)(.0025) + .0041}$$

$$\sigma_P = \text{SQRT}(.0119)$$

$$\sigma_P = .1091 \text{ or } 10.91\%$$

A weighted average of the individual standard deviations is _INCORRECT_.



Determining Portfolio Standard Deviation

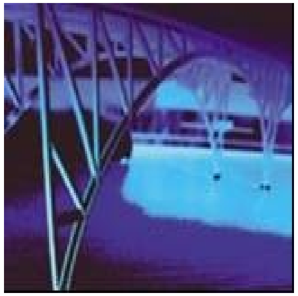
The WRONG way to calculate is a weighted average like:

$$\sigma_P = .4\,(13.15\%) + .6(10.65\%)$$

$$\sigma_P = 5.26 + 6.39 = 11.65\%$$

$$10.91\% \neq 11.65\%$$

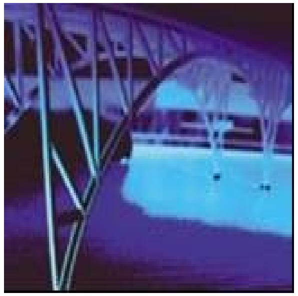
This is *INCORRECT*.



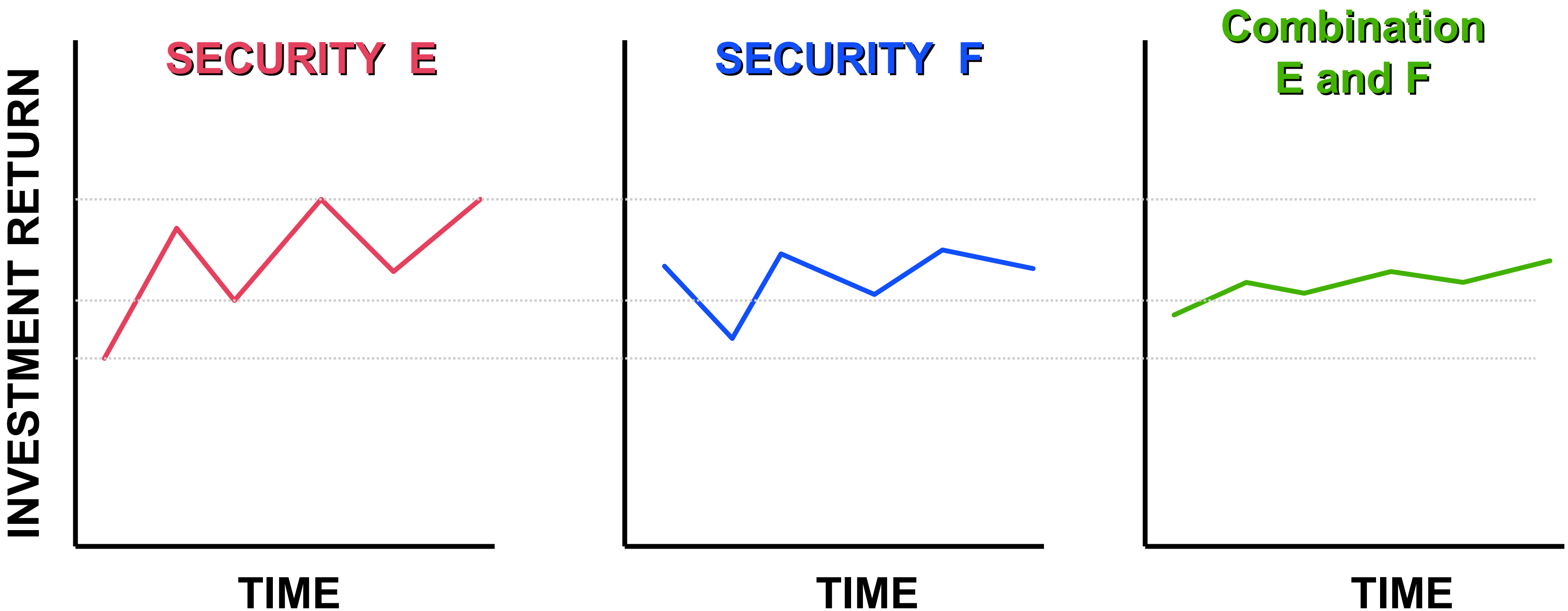
Summary of the Portfolio Return and Risk Calculation

	Stock C	Stock D	Portfolio
Return	9.00%	8.00%	8.64%
Stand. Dev.	13.15%	10.65%	10.91%
CV	1.46	1.33	1.26

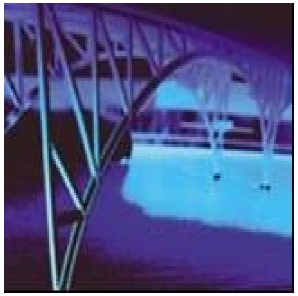
The portfolio has the *LOWEST* coefficient of variation due to diversification.



Diversification and the Correlation Coefficient



Combining securities that are not perfectly, positively correlated reduces risk.

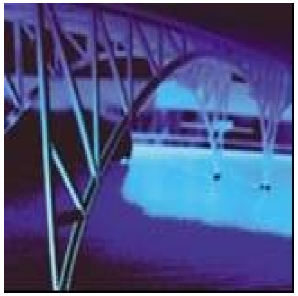


Total Risk = Systematic Risk + Unsystematic Risk

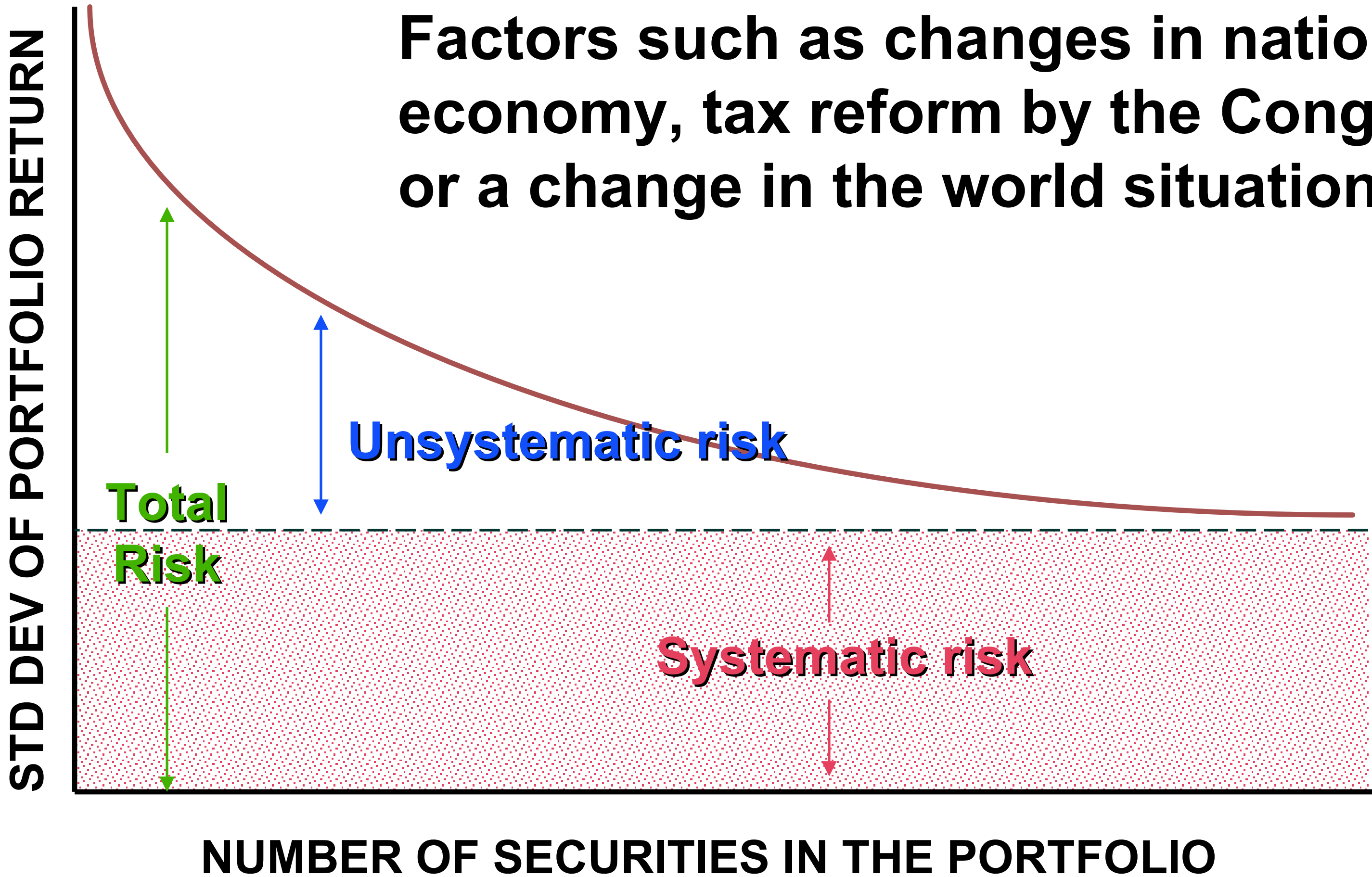
Total Risk = ***Systematic Risk*** + ***Unsystematic Risk***

Systematic Risk **is the variability of return on stocks or portfolios associated with changes in return on the market as a whole.**

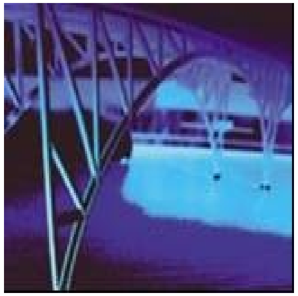
Unsystematic Risk **is the variability of return on stocks or portfolios not explained by general market movements. It is avoidable through diversification.**



Total Risk = Systematic Risk + Unsystematic Risk

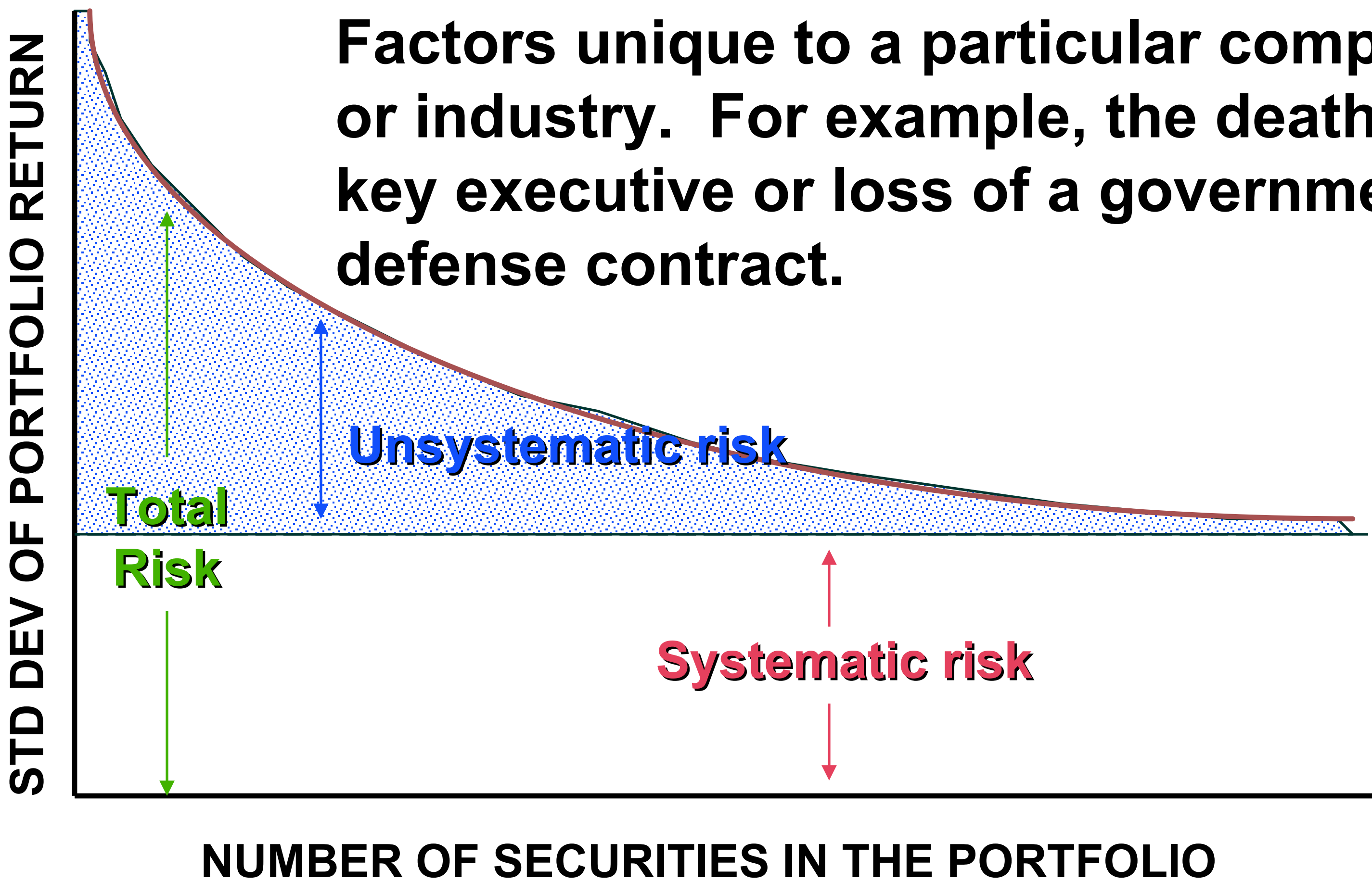


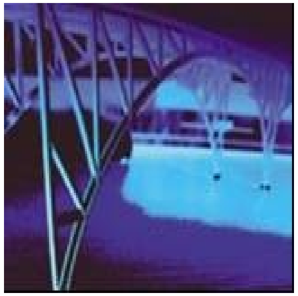
Factors such as changes in nation's economy, tax reform by the Congress, or a change in the world situation.



Total Risk = Systematic Risk + Unsystematic Risk

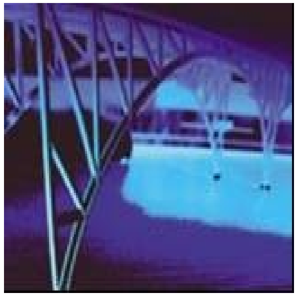
Factors unique to a particular company or industry. For example, the death of a key executive or loss of a governmental defense contract.





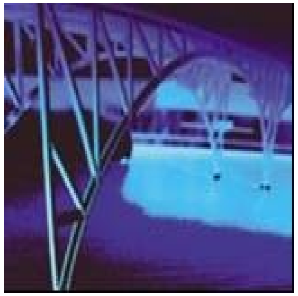
Capital Asset Pricing Model (CAPM)

CAPM is a model that describes the *relationship* between risk and expected (required) return; in this model, a security's expected (required) return is the risk-free rate plus a premium based on the *systematic risk* of the security.

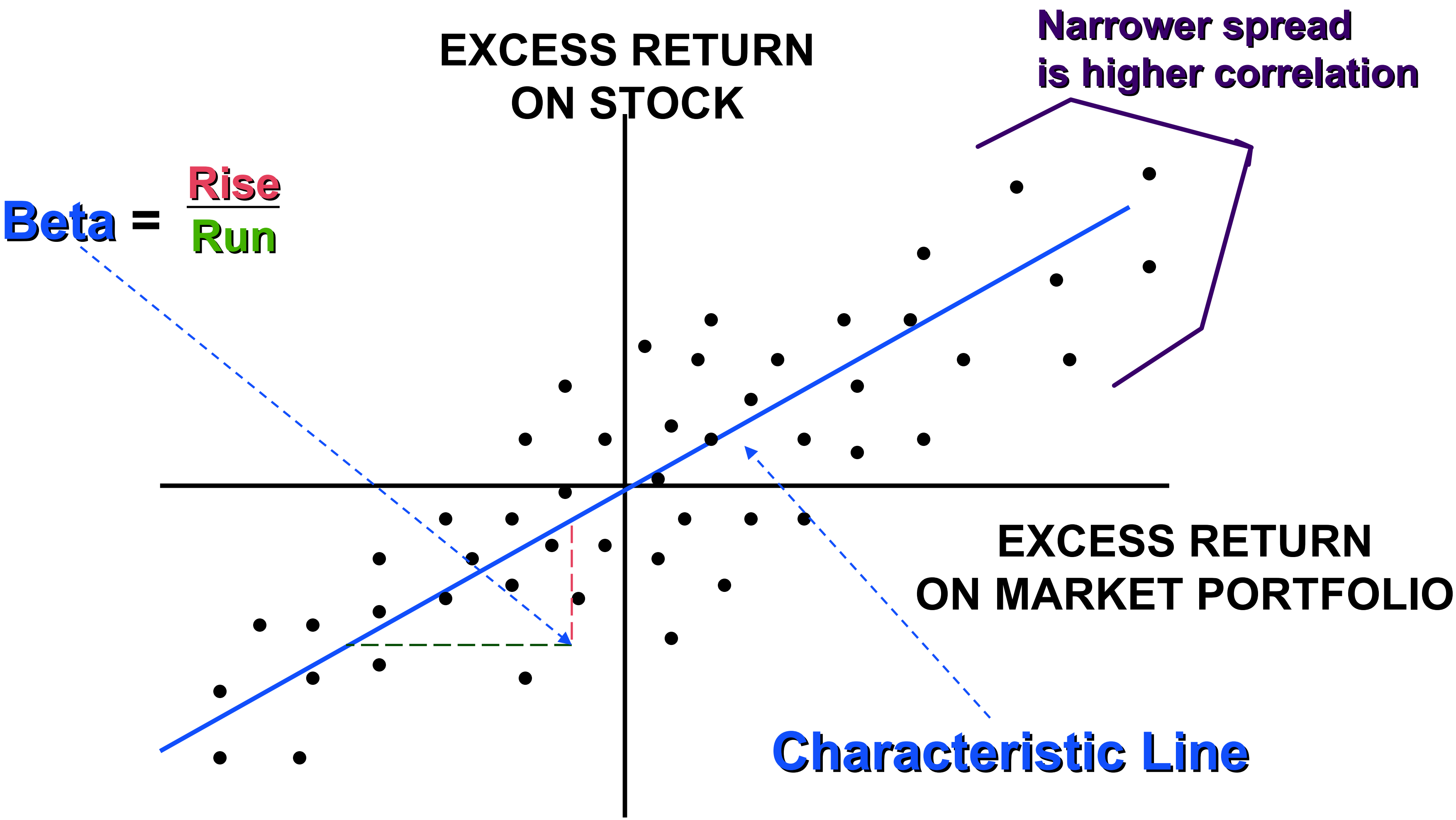


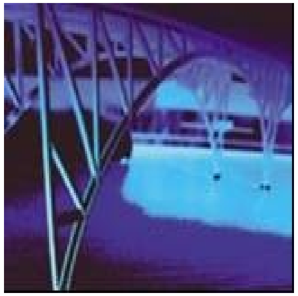
CAPM Assumptions

1. Capital markets are efficient.
2. Homogeneous investor expectations over a given period.
3. *Risk-free* asset return is certain (use short- to intermediate-term Treasuries as a proxy).
4. Market portfolio contains ***only*** *systematic risk* (use S&P 500 Index or similar as a proxy).



Characteristic Line

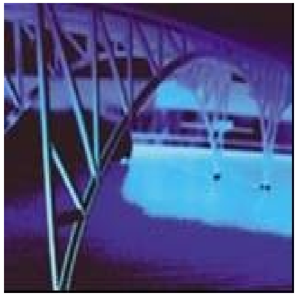




Calculating "Beta" on Your Calculator

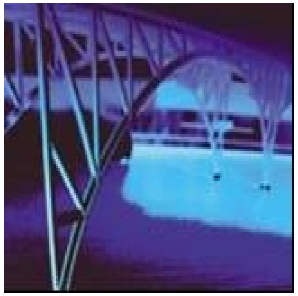
Time Pd.	Market	My Stock
1	9.6%	12%
2	-15.4%	-5%
3	26.7%	19%
4	-.2%	3%
5	20.9%	13%
6	28.3%	14%
7	-5.9%	-9%
8	3.3%	-1%
9	12.2%	12%
10	10.5%	10%

The *Market* and *My Stock* returns are "excess returns" and have the riskless rate already subtracted.



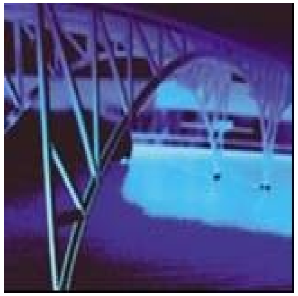
Calculating "Beta" on Your Calculator

- **Assume that the previous continuous distribution problem represents the "excess returns" of the market portfolio (it may still be in your calculator data worksheet --2nd Data).**
- Enter the excess market returns as "X" observations of: 9.6%, -15.4%, 26.7%, -0.2%, 20.9%, 28.3%, -5.9%, 3.3%, 12.2%, and 10.5%.
- Enter the excess stock returns as "Y" observations of: 12%, -5%, 19%, 3%, 13%, 14%, -9%, -1%, 12%, and 10%.



Calculating “Beta” on Your Calculator

- Let us examine again the statistical results (Press 2nd and then Stat)
- The market expected return and standard deviation is 9% and 13.32%. Your stock expected return and standard deviation is 6.8% and 8.76%.
- The regression equation is Y=a+bX. Thus, our characteristic line is Y = 1.4448 + 0.595 X and indicates that our stock has a beta of 0.595.

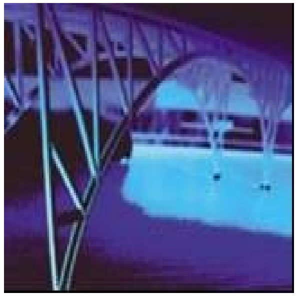


What is Beta?

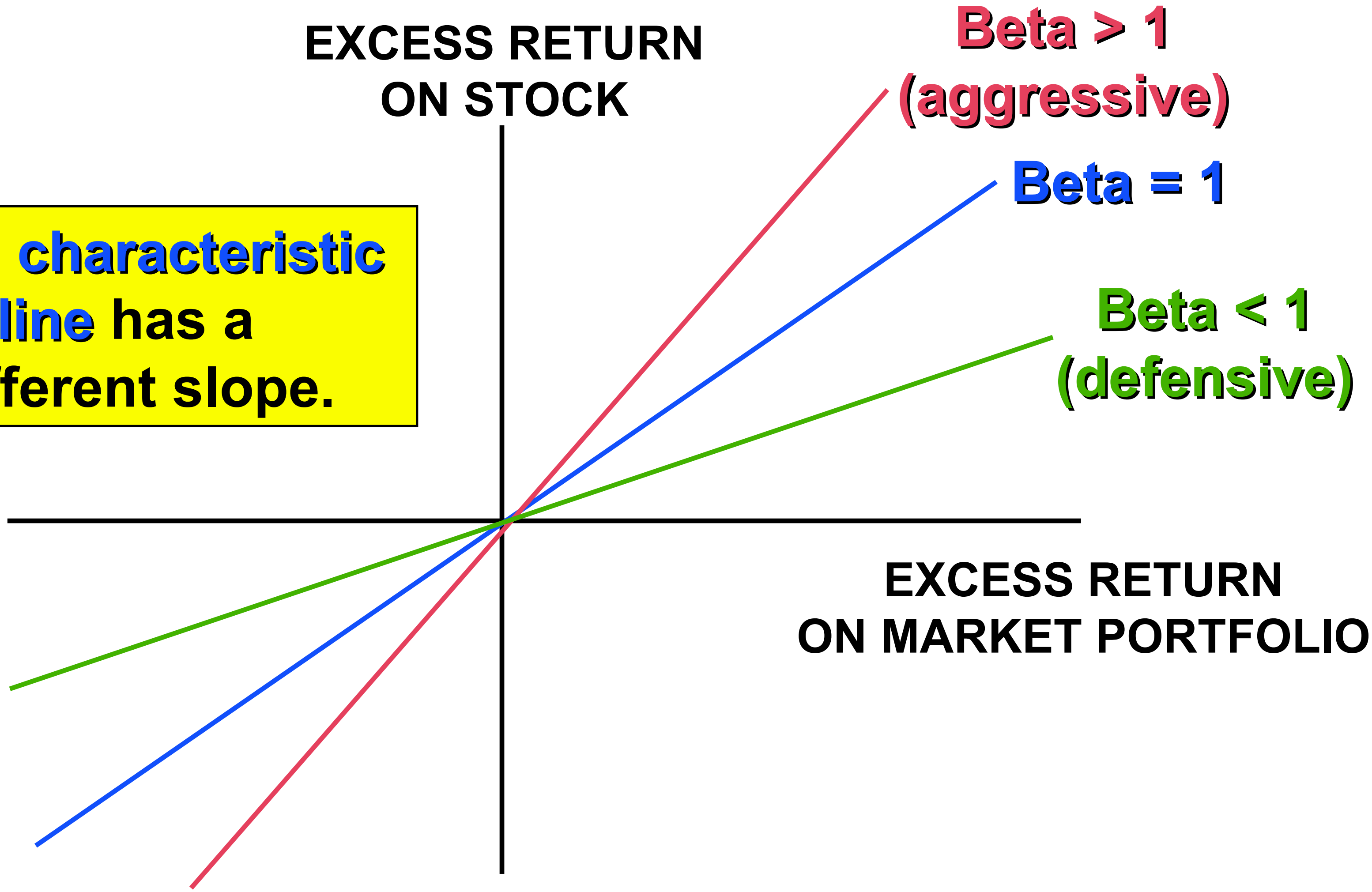
An index of ***systematic risk***.

It measures the ***sensitivity*** of a stock's returns to changes in returns on the market portfolio.

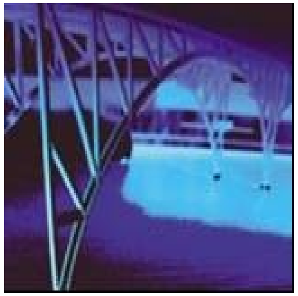
The ***beta*** for a portfolio is simply a weighted average of the individual stock betas in the portfolio.



Characteristic Lines and Different Betas



Each **characteristic line** has a different slope.



Security Market Line

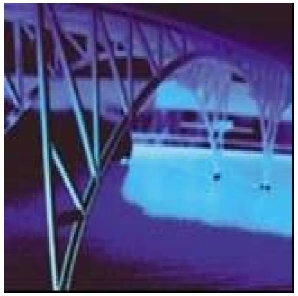
$$\bar{R}_j = R_f + \beta_j(\bar{R}_M - R_f)$$

$\bar{R}_j$ is the required rate of return for stock j,

R_f is the risk-free rate of return,

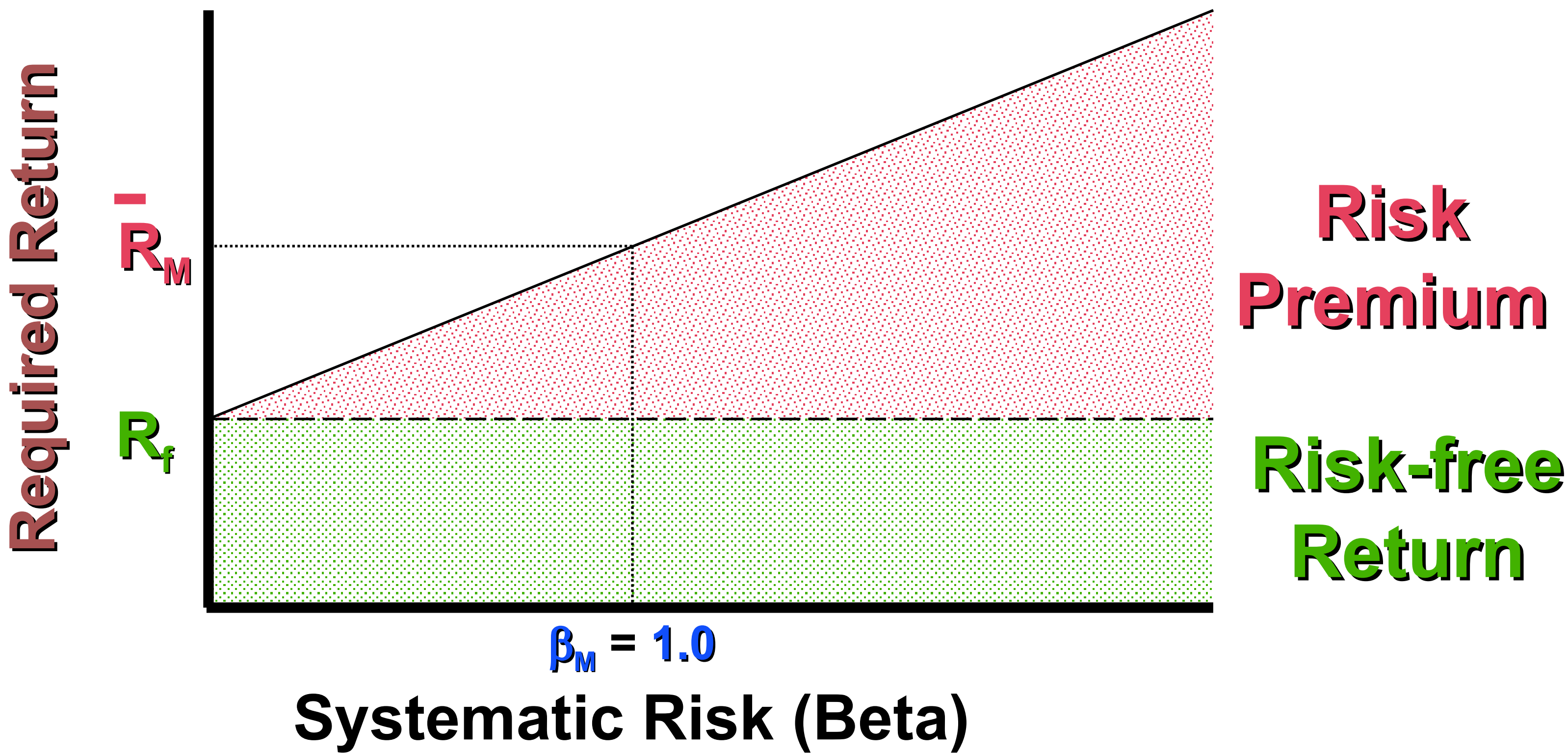
β_j is the beta of stock j (measures systematic risk of stock j),

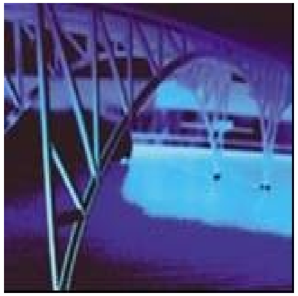
$\bar{R}_M$ is the expected return for the market portfolio.



Security Market Line

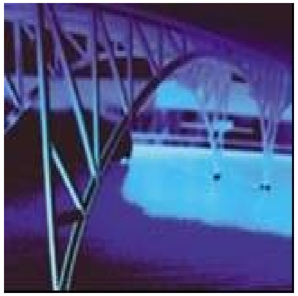
$$\bar{R}_j = R_f + \beta_j(\bar{R}_M - R_f)$$





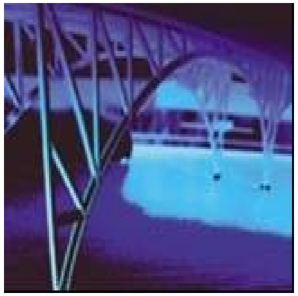
Security Market Line

- **Obtaining Betas**
  - **Can use historical data if past best represents the expectations of the future**
  - **Can also utilize services like Value Line, Ibbotson Associates, etc.**
- **Adjusted Beta**
  - **Betas have a tendency to revert to the mean of 1.0**
  - **Can utilize combination of recent beta and mean**
    - **2.22 (.7) + 1.00 (.3) = 1.554 + 0.300 = 1.854 estimate**



Determination of the Required Rate of Return

Lisa Miller at *Basket Wonders* is attempting to determine the rate of return required by their stock investors. Lisa is using a 6% R_f and a long-term market expected rate of return of 10%. A stock analyst following the firm has calculated that the firm beta is 1.2. What is the *required rate of return* on the stock of *Basket Wonders*?



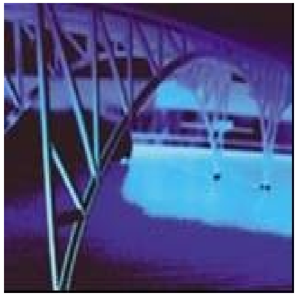
BWs Required Rate of Return

$$\bar{R}_{BW} = R_f + \beta_j(\bar{R}_M - R_f)$$

$$\bar{R}_{BW} = 6\% + 1.2(10\% - 6\%)$$

$$\bar{R}_{BW} = 10.8\%$$

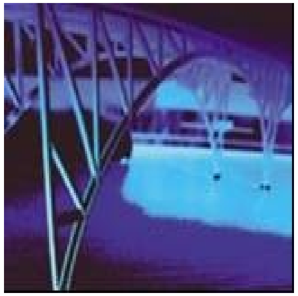
The required rate of return exceeds the market rate of return as BW's beta exceeds the market beta (1.0).



Determination of the Intrinsic Value of BW

Lisa Miller at BW is also attempting to determine the intrinsic value of the stock. She is using the constant growth model. Lisa estimates that the dividend next period will be $0.50 and that BW will grow at a constant rate of 5.8%. The stock is currently selling for $15.

What is the intrinsic value of the stock? Is the stock over or underpriced?



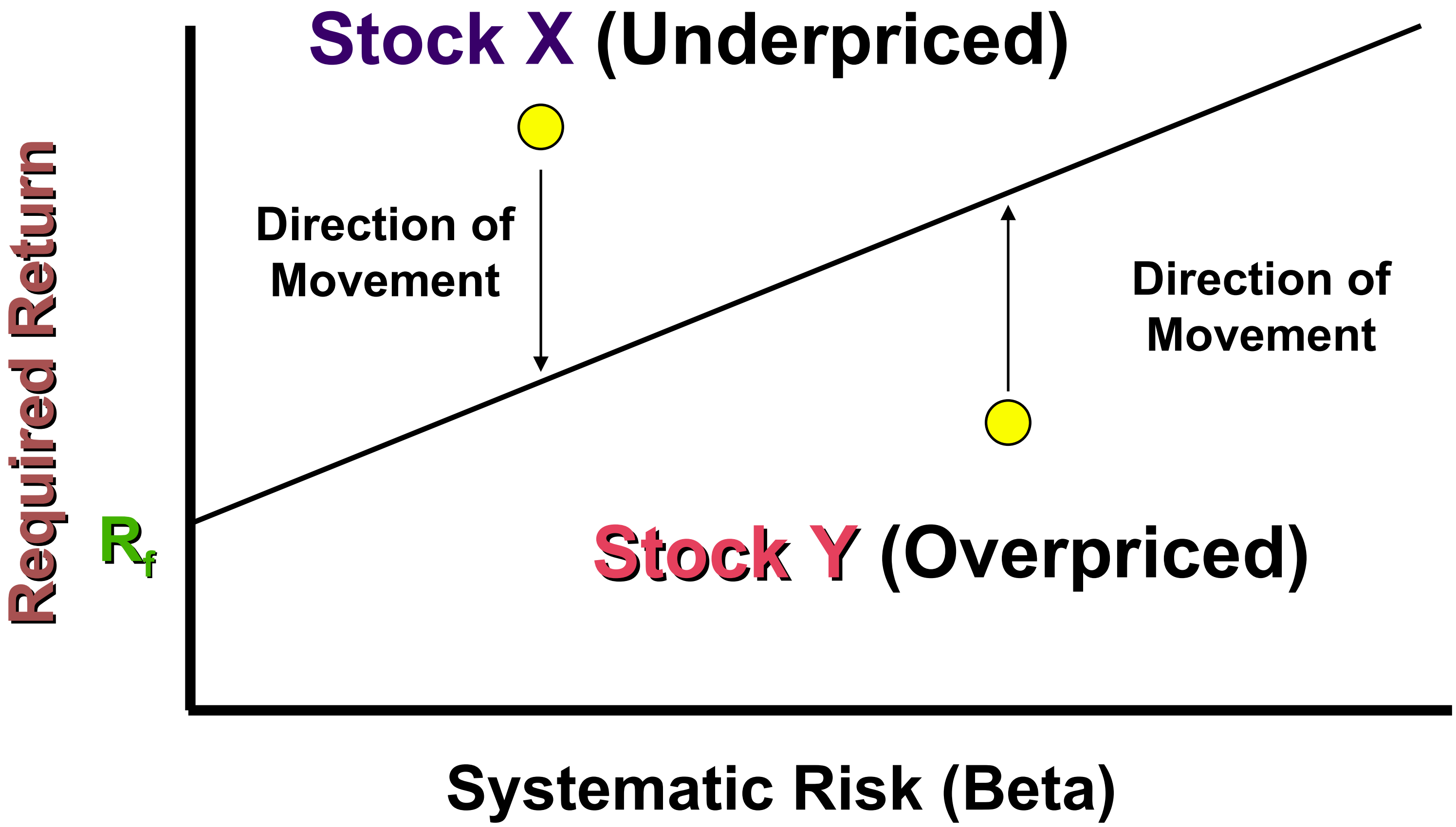
Determination of the Intrinsic Value of BW

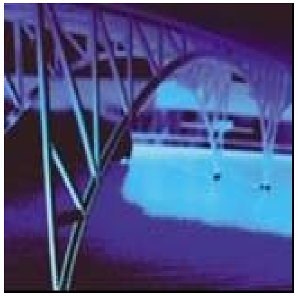
$$\text{Intrinsic Value} = \frac{\$0.50}{10.8\% - 5.8\%}$$

$$= \$10$$

The stock is *OVERVALUED* as the market price ($15) exceeds the intrinsic value ($10).

Security Market Line





Determination of the Required Rate of Return

Small-firm Effect

Price / Earnings Effect

January Effect

These anomalies have presented serious challenges to the CAPM theory.

Stock Valuation

Valuation

- The determination of what a stock is worth; the stock's intrinsic value
- If the price exceeds the valuation, buy the stock.
- If the price is less than the valuation, short the stock.

Cash Flows for Stockholders

If you buy a share of stock, you can receive cash in two ways

- The company pays dividends
- You sell your shares, either to another investor in the market or back to the company

- As with bonds, the price of the stock is the present value of these expected cash flows

Dividend Characteristics

- Dividends are not a liability of the firm until a dividend has been declared by the Board
- A firm is not default for not declaring dividends
- Dividends and Taxes
  - Dividend payments are not considered a business expense, therefore, they are not tax deductible
  - Dividends received by individuals are taxed as ordinary income
  - Dividends received by corporations have a minimum 70% exclusion from taxable income

Dividend Valuation Model

If the dividend is fixed, valuation is:

$$V = \frac{D}{k}$$

Dividend Growth Model

Value depends on the

- the required return,
- the dividend, and
- the growth in the dividend.

Valuing Common Stock Using the Discounted Dividend Model

- Similar to bonds, the value of common stock is equal to the present value of all future cash flows that the stockholder expects to receive from owning the shares of stock.
- Unlike bonds, the future cash flows in the form of dividends are not fixed. Thus, the value of common stock is derived from discounting "expected dividend."

Three Step Procedure for Valuing Common Sto

1. Estimate the amount and timing of future cash flows the common stock is expected to provide.

2. Evaluate the riskiness of the future dividends, and determine the rate of return an investor might expect to receive from a comparable risky investment, which becomes the investor’s required rate of return.

3. Calculate the present value of the expected dividends by discounting them back to the present at the investor’s required rate of return.

Stock Pricing: Example

There is a share of common stock you plan to hold for only one year. What will be the value of the stock today if it pays a dividend of $2.00, is expected to have a price of $75 and the investor's required rate of return is 12%?

Value of Common stock

= Present Value of future cash flows

= Present Value of (dividend + expected selling price)

$= (\$2 + \$75) \div (1.12)^1$

= **$68.75**

N: 1
PMT: 2
FV: 75
I/Y: 12
PV = – 68.75

Stock Pricing: Example

What will be the value of common stock if you hold the stock for two years and sell it for $82? Assume the dividend payment is fixed at $2 per year.

Value of Common stock

= Present Value of future cash flows

= Present Value of (dividends + expected selling price)

$= \{(\$2) \div (1.12)^1\} + \{(\$2+\$82) \div (1.12)^2\}$

N: 2
PMT: 4
FV: 82
I/Y: 12
PV = – 72.1301

One Period Example

Suppose you are thinking of purchasing the stock of Ford Motor Company and you expect it to pay a $2 dividend in one year and you believe that you can sell the stock for $14 at that time. If you require a return of 20% on investments of this risk, what is the maximum you would be willing to pay?

- Compute the PV of the expected cash flows
- Price = (14 + 2) ÷ (1.2)

N: 1
PMT: 0
FV: 16
I/Y: 20
PV = −13.3333

Two Period Example

Now what if you decide to hold the stock for two years? In addition to the dividend in one year, you expect a dividend of \$2.10 in and a stock price of \$14.70 at the end of year 2. Now how much would you be willing to pay?

– $PV = 2 \div (1.2) + (2.10 + 14.70) \div (1.2)^2$

CF0: 0
C01: 2
F01: 1
C02: 16.80
F02: 1
I = 20
NPV = −13.3333

Three Period Example

Finally, what if you decide to hold the stock for three periods? In addition to the dividends at the end of years 1 and 2, you expect to receive a dividend of $2.205 at the end of year 3 and a stock price of $15.435. Now how much would you be willing to pay?

– $PV = 2 / 1.2 + 2.10 / (1.2)^2 + (2.205 + 15.435) / (1.2)^3$

CF0: 0
C01: 2
F01: 1
C02: 2.10
F02: 1
CO3: 17.64
F03: 1
I = 20
NPV = −13.3333

Stock Valuation: Constant Dividends

- Since stocks do not have a maturity period, we can consider the value of stock to be equal to the present value of future expected dividends over a certain period and an expected selling price.

- Valuing common stocks using general discounted cash flow model is made difficult as analyst has to forecast each of the future dividends. This problem is greatly simplified if we assume that dividends grow at a fixed or constant rate.

Constant Dividend Growth Model

If the dividend grows at a constant rate, valuation is:

$$V = D_0 \frac{(1+g)}{(k-g)}$$

Constant Dividend Growth Rate Model

$$V_{cs} = \frac{D_0(1+g)}{r_{cs} - g} = \frac{\text{Dividend in year 1}}{\text{Stockholders' Required Rate of Return} - \text{Growth Rate}}$$

- V_{cs} = Value of a share of common stock
- D_0 = Annual cash dividend in the year of valuation (paid already)
- g = annual growth rate in the dividend
- r_{cs} = the common stockholder’s required rate of return

Constant Dividend Growth Rate Model

Mattco common stock paid a $2 dividend at the end of last year and is expected to pay a cash dividend every year in perpetuity. Each year, the dividends are expected to grow at a rate of 10%.

Based on an assessment of the riskiness of the common stock, the investor's required rate of return is 15%. What is the value of this common stock?

$$V_{cs} = \frac{D_0(1+g)}{r_{cs}-g} = \frac{2(1+.10)}{.15-.10} = 44$$

Zero Growth Model

If dividends are expected at regular intervals forever, then this is like preferred stock and is valued as a perpetuity

$$P_0 = D \div R$$

Suppose stock is expected to pay a \$0.50 dividend every quarter and the required return is 10% with quarterly compounding. What is the price?

→ $P_0 = .50 \div (0.1 \div 4) = \$20$

Zero Growth Model: Example

Suppose Y-Corp. just paid a dividend of $.50. It is expected to increase its dividend by 2% per year. If the market requires a return of 15% on assets of this risk, how much should the stock be selling for?

P_0 = .50(1+.02) ÷ (.15 - .02) = $3.92

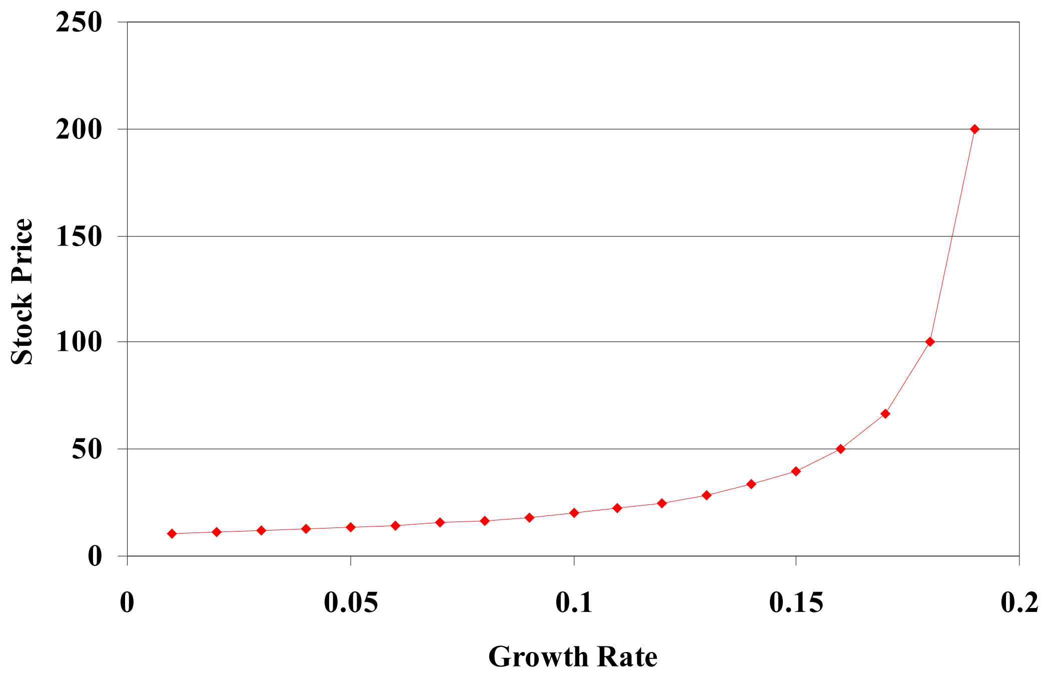
Zero Growth Model: Example

Z-Corp. is expected to pay a $2 dividend in one year. If the dividend is expected to grow at 5% per year and the required return is 20%, what is the price?

$\rightarrow P_0 = 2 \div (.2 - .05) = \$13.33$

Stock Price Sensitivity to Dividend Growth

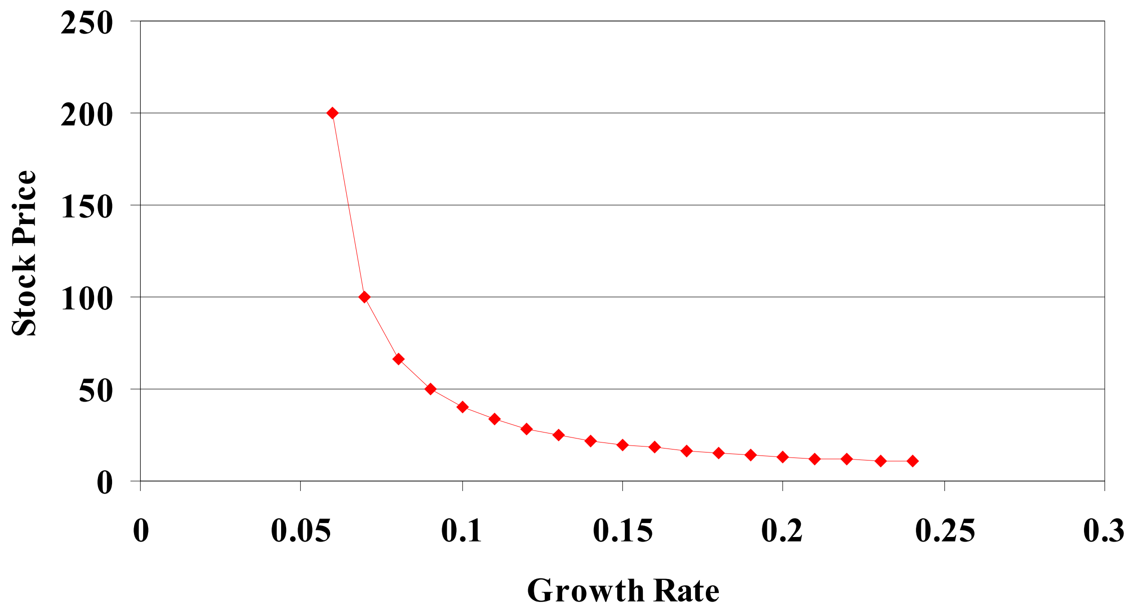
D_1 = \$2; R = 20%



As the growth rate approaches the required return, the stock price increases dramatically.

Stock Price Sensitivity to Required Return

$D_1 = \$2; g = 5\%$



As the required return approaches the growth rate, the price increases dramatically. This graph is a mirror image of the previous one.

The Cause of Stock Price Fluctuations

$$V_{cs} = \frac{D_0(1 + g)}{r_{cs} - g} = \frac{\text{Dividend in year 1}}{\text{Stockholders' Required Rate of Return} - \text{Growth Rate}}$$

There are three variables that drive share value:

- ✓ The most recent dividend (D_0): The more, the higher.
- ✓ Expected rate of growth in future dividends (g): The higher, the higher.
- ✓ Investor's required rate of return (r_{cs}): The higher, the lower.

Since most recent dividend (D_0) has already been paid, it cannot be changed. Thus, variations in the other two variables, r_{cs} and g, can lead to changes in stock prices.

Determinants of the Investor’s Required Rate of Return

The investor’s required rate of return is determined by two key factors:

- The level of interest rates in the economy
- The risk of the firm’s stock.

If risk-free rate and/or systematic risk (beta) rises, the investor’s required rate of return will rise and the stock value will fall.

Required Return: Example

Suppose a firm's stock is selling for $10.50. They just paid a $1 dividend and dividends are expected to grow at 5% per year. What is the required return?

→ R = [1(1.05) ÷ 10.50] + .05 = 15%

- What is the dividend yield?

  → 1(1.05) ÷ 10.50 = 10%

- What is the capital gains yield?

  → g =5%

Determinants of Growth Rate of Future Dividends

Firm's growth opportunities relate to:

- The rate of return the firm expects to earn when they reinvest earnings (the return on equity, ROE), and

- The proportion of firm's earnings that they reinvest. This is known as the retention ratio, b, = 1- dividend payout ratio.

The growth rate can be formally expressed as follows:

- g = the expected rate of growth of dividends

- D_1/E_1 = the dividend payout ratio

- ROE = the return on equity earned when the firm reinvests a portion of its earning back into the firm

$$\text{Rate of Growth in Dividends } (g) = \left(1 - \text{Dividend Payout Ratio}\right) \times \text{Rate of Return on Equity } (ROE)$$

P/E Ratio Valuation Model

- Price/Earnings ratio (**P/E ratio**) is a popular measure of stock valuation.
- **P/E ratio** is a relative value model because it tells the investor how many dollars investors are willing to pay for each dollar of the company's earnings.

  - V_{cs} = the value of common stock of the firm.
  - P/E_1 = the price earnings ratio for the firm based on the current price per share divided by earnings for end of year 1.
  - E_1 = estimated earnings per share of common stock for the end of year 1.

$$\begin{matrix}\text{Value of}\\ \text{Common Stock,}\\ V_{cs}\end{matrix} = \left(\begin{matrix}\text{Appropriate}\\ \text{Price Earnings Ratio}\end{matrix}\right) \times \left(\begin{matrix}\text{Estimated Earnings}\\ \text{Per Share for Year 1}\end{matrix}\right) = \frac{P}{E_1} \times E_1$$

Preferred Stock

Dividend:

- In general, size of preferred stock dividend is ***fixed***, and it is either stated as a dollar amount or as a percentage of the preferred stock's par value.

- Unlike common stockholders, preferred stockholders receive the same fixed dividend regardless of how well the firm does.

Multiple Classes:

- If a company chooses, it can issue more than one class of preferred stock, and each class can have different characteristics.

- For example, Public Storage (PSA) has 16 different issues of preferred stock outstanding that vary in terms of dividend, convertibility, seniority.

Table 10.1 Examples of Different Pacific Gas & Electric (PCG) Preferred Stock Issues Outstanding, June 2009

Name	Symbol	Par Value	Price	Dividend	Dividend Yield
Pacific Gas & Electric 6% PF	PCGprA	$25.00	$25.08	$1.50	6.00%
Pacific Gas & Electric 5% RED 1ST PF D	PCGprD	$25.00	$21.00	$1.25	6.00%
Pacific Gas & Electric 4.80% PFD G	PCGprG	$25.00	$20.10	$1.20	6.00%
Pacific Gas & Electric 4.36% PF I	PCGprI	$25.00	$18.25	$1.09	6.00%

Preferred Stock

Claims on Assets and Income:

- In the event of bankruptcy, preferred stockholders have priority over common stock. However, they have lower priority than the firm's debt holders.
- Firm must pay dividends on preferred stock prior to paying dividend on common stock.
- Most preferred stock carry a **cumulative feature**. Cumulative feature requires that all past unpaid dividends to be paid before any common stock dividends can be declared.
- Thus, preferred stocks are less risky than common stocks but more risky than bonds.

Preferred Stock

Preferred Stock are a Hybrid Security

- Like common stocks, preferred stocks do not have a fixed maturity date. Also, like common stocks, nonpayment of dividends does not lead to bankruptcy of the firm.

- Like debt, preferred stocks have a fixed dividend. Also, most preferred stocks are periodically retired even though there is no stated maturity date.

Features of Preferred Stock

Dividends

- Stated dividend that must be paid before dividends can be paid to common stockholders
- Dividends are not a liability of the firm and preferred dividends can be deferred indefinitely
- Most preferred dividends are cumulative – any missed preferred dividends have to be paid before common dividends can be paid

- Preferred stock generally does not carry voting rights

Preferred Stock Valuation

Since preferred stockholders generally receive a fixed dividend and the stocks are perpetuities (non-maturing), it can be valued using the present value of perpetuity equation.

$$V_{ps} = \frac{D_{ps}}{r_{ps}}$$

$$\text{Value of Preferred Stock} = \frac{\text{Annual Preferred Stock Dividend}}{\text{Market's Required Yield on Preferred Stock}}$$

Yield on Preferred Stock: Example

What will be the yield on XYZ's preferred stock if the company has promised annual dividend of $1.20 per share and each share is currently selling for $32.50?

$$r_{ps} = \frac{D_{ps}}{V_{ps}} = \frac{1.2}{32.5} = 0.0369 = 3.69\%$$

Pricing of Preferred Stock: Example

Consider Consolidated Edison’s preferred stock issue, which pays an annual dividend of $5.00 per share, does not have a maturity date, and on which the market’s required yield or promised rate of return (rps) for similar shares of preferred stock is 6.02%. What is the value of the Con Ed’s preferred stock?

$$V_{ps} = \frac{D_{ps}}{r_{ps}} = \frac{5.00}{0.0602} = \$83.06.$$

Pricing of Preferred Stock: Example

What is the present value of a share of preferred stock that pays a dividend of $12 per share if the market's yield on similar issues of preferred stock is 8%?

$$V_{ps} = \frac{D_{ps}}{r_{ps}} = \frac{12.00}{0.08} = \$150.$$

Table 10.2 Summary of Discounted Cash Flow Valuation of Bonds, Preferred Stock, and Common Stock

Bonds and preferred stock state a promised cash payment to the security holder. In the case of a bond, interest and principal must be paid in accordance with the terms of the bond contract (indenture). Preferred shares have stated dividend yields, which when multiplied by the face or par value of the preferred stock, equal the promised preferred dividend. Both bonds and preferred stock are valued by discounting these promised cash flows back to the present. However, since these are promised (and not expected) cash flows, we discount the cash flows using promised rate of return as reflected in current market prices of similar securities. Common stock, on the other hand, does not have a contractual promised dividend payment, so we apply the discounted cash flow model in this instance by estimating expected future dividends and then discounting them back to the present using the expected rate of return that an investor would require if investing in a stock with the risk attributes of the shares being valued.

Type of Security	Cash Flow	Discount Rate	Valuation Model
Bond	**Promised interest and principal payments**. These payments are set forth in the contract between the bond issuing company and the owner of the bond.	**Market's required yield to maturity (YTM market)**. Typically the YTM on a similar bond is used to value a bond. This YTM is the realized rate of return to the bondholder *only* if all promised payments are made on time. Consequently, the yield to maturity calculated for a bond is a promised yield and not the expected yield.	$\text{Bond Value} = \text{Interest}\left[\frac{1 - \frac{1}{(1 + YTM\ \text{market})^n}}{YTM\ \text{market}}\right] + \text{Principal}\left[\frac{1}{(1 + YTM)^n}\right]$
Preferred stock	**Promised dividends.** Dividends are defined using a contractually set dividend yield that is multiplied by the par or face value of the preferred stock to get the preferred stock dividend.	**Market or promised yield on preferred stock**. We typically calculate this yield using market prices and promised dividends for similar shares of preferred stock. This yield is a promised yield that will only be earned if the preferred stock dividends are fully paid every period as promised.	$\text{Value of Preferred Stock } (V_{ps}) = \frac{\text{Annual Preferred Stock Dividend}}{\text{Market's Required Yield on Preferred Stock}} = \frac{D_{ps}}{r_{ps}}$
Common stock	**Expected future dividends.** No dividend is prescribed for common stock. Instead dividends must be estimated, so we value common stock using expected rather than promised future cash flows. In the constant dividend growth rate model dividends are estimated using a constant rate of growth from year to year.	**Investor's expected rate of return which is the investor's required rate of return**. Since common stock dividends are risky we used expected future dividends and discount them using a risk-adjusted or expected rate of return for investing in shares of stock of firms with similar risk to the common stock being valued. We can estimate this expected rate of return using the CAPM.	$\text{Value of Common Stock } (V_{cs}) = \frac{D_0(1 + g)}{r_{cs} - g}$