RISK, RETURN & CAPITAL MARKET HISTORY

This Lecture will expose you to:

1. Some Questions to Guide Our Analysis: The Big Picture
2. How to Calculate Returns
3. The Relationship between Inflation and Returns
4. The Historical Record: Year-to-year total returns on common stocks - Average annual returns 5. What's the difference between Returns and Risk Premiums
5. How to calculate measures of the Variability of Returns: standard deviations and frequency distributions
6. Summary and Conclusions

1.0 QUESTIONS TO GUIDE OUR ANALYSIS

1. IF WE GET A 15% RETURN IS THAT GOOD?
   - relative to a benchmark
   - inflation
   - discount rate
   - risk: dispersion

2. HOW TO QUANTIFY AND ADJUST FOR RISK?
   - DISTINCTION: EXPECTED RETURN VS. REALIZED RETURN

   DISPERSION (WANT TO SAVE JOB)

   OIL PROJECT: EXPECTED RETURN 15%

   STD 30%

3. WHERE DO DISCOUNT RATES COME FROM?

- WHY IS THE DISCOUNT RATE THE OPPORTUNITY COST FOR THE FIRM?
- LOOK TO HISTORY AS GUIDE FOR PRESENT

4. WHY DO WE CARE ABOUT RISK?

- POTENTIAL OF BAD OUTCOMES
- IF TRULY INDEPENDENT CAN GET MULTIPLE BAD DRAWS

==> HISTORICAL PRICE DOES NOT MATTER

- Risk Preferences are different across individuals!

==> It is not enough to say "I DON'T LIKE RISK" - We want to measure how much risk individuals want to avoid.

2.0 CALCULATING RETURNS

- income component - direct cash payments such as dividends or interest
- price change - loosely, capital gain or loss

The return calculation is unaffected by the decision to cash out or hold securities.

Percentage Return: Refers to the rate per dollar invested.

Realized Percentage Return =

Dividend Yield + Capital Gains Yield

Where: Dividend Yield = D_t/P_{t-1}

Capital Gains Yield = $(P_t - P_{t-1}) / P_{t-1}$

3.0 INFLATION AND RETURNS

A. Real versus Nominal Returns

- Nominal Returns - returns not adjusted for inflation; percentage change in nominal dollars.
- Real Returns - returns that have been adjusted for inflation; percentage change in purchasing power.

B. The Fisher Effect

1. A expected relationship between nominal returns, real returns, and the expected inflation rate. Let r be the nominal rate, R be the real rate, and i_f be the expected inflation rate,

   $(1 + r) = (1+ R) \times (1+ i_f)$

   hence $r = R + i_f + (R \times i_f)$).

2. A definition whereby the real rate can be found by deflating the nominal rate by the inflation rate:

   $R = (1 + r) / (1 + i_f) - 1$.

4.0 AVERAGE RETURNS

A. Calculating Average Returns

ARITHMETIC AVERAGE: add them up, divide by T

- $AAR = \sum_{t=1}^{T} \frac{r_{it}}{T}$
- used in calculation of single period expectation.

GEOMETRIC AVERAGE RETURNS (HOLDING PERIOD RETURNS):

- $GAR = [\prod_{t=1}^{T}(1+r_{it})]^{1/T} - 1$
- used in calculation of holding period returns.

GAR/Holding-Period Returns

The holding period return is the return that an investor would get when holding an investment over a period of *n* years, when the return during year *i* is given as r_i :

$$\text{holding period return} =$$
$$= (1+r_1)\times(1+r_2)\times\cdots\times(1+r_n)-1$$

Note the GAR is annualized version of the holding period return.

Holding Period Return: Example

Suppose your investment provides the following returns over a four-year period:

Year	*Return*
1	10%
2	-5%
3	20%
4	15%

Your holding period return =

$$= (1+r_1)\times(1+r_2)\times(1+r_3)\times(1+r_4)-1$$
$$= (1.10)\times(.95)\times(1.20)\times(1.15)-1$$
$$= .4421 = 44.21\%$$

Holding Period Return (GAR): Example

An investor who held this investment would have actually realized an annual return of 9.58%:

Year	*Return*
1	10%
2	-5%
3	20%
4	15%

Geometric average return =

$$(1+r_g)^4 = (1+r_1)\times(1+r_2)\times(1+r_3)\times(1+r_4)$$

$$r_g = \sqrt[4]{(1.10)\times(.95)\times(1.20)\times(1.15)} - 1$$

$$= .095844 = 9.58\%$$

- So, our investor made 9.58% on his money for four years, realizing a holding period return of 44.21%

$$1.4421 = (1.095844)^4$$

Arithmetic Average Return: Example

Note that the arithmetic average is not the same thing as the holding period or geometric average:

Year	*Return*
1	10%
2	-5%
3	20%
4	15%

$$\text{Arithmetic average return} = \frac{r_1 + r_2 + r_3 + r_4}{4}$$

$$= \frac{10\% - 5\% + 20\% + 15\%}{4} = 10\%$$

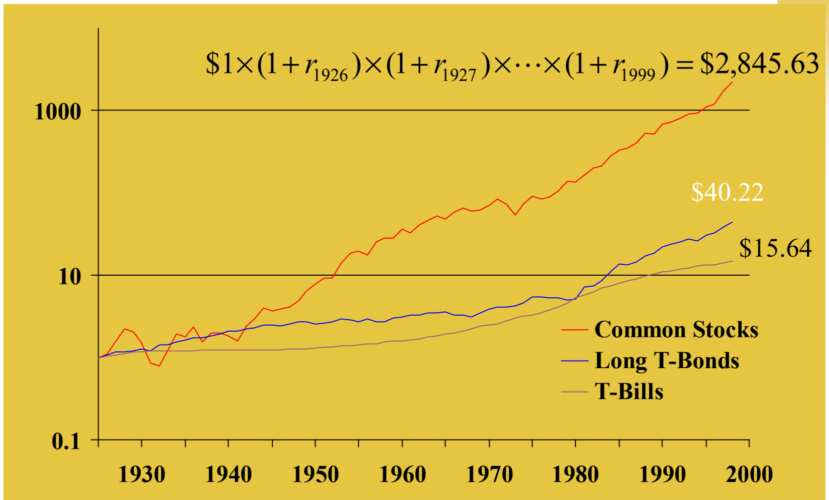
Holding Period Returns

A famous set of studies dealing with the rates of returns on common stocks, bonds, and Treasury bills was conducted by Roger Ibbotson and Rex Sinquefield.

They present year-by-year historical rates of return starting in 1926 for the following five important types of financial instruments in the United States:

- Large-Company Common Stocks
- Small-company Common Stocks
- Long-Term Corporate Bonds
- Long-Term U.S. Government Bonds
- U.S. Treasury Bills

The Future Value of an Investment of $1 in 1926



Source: © ***Stocks, Bonds, Bills, and Inflation 2000 Yearbook***™, Ibbotson Associates, Inc., Chicago (annually updates work by Roger G. Ibbotson and Rex A. Sinquefield).

Return Statistics

The history of capital market returns can be summarized by describing the

- average return

$$\overline{R} = \frac{(R_1 + \cdots + R_T)}{T}$$

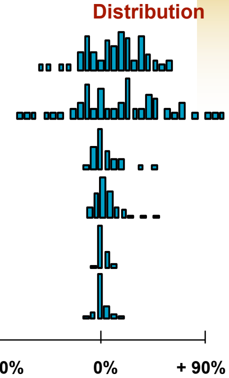
- the standard deviation of those returns

$$SD = \sqrt{VAR} = \sqrt{\frac{(R_1 - \overline{R})^2 + (R_2 - \overline{R})^2 + \cdots (R_T - \overline{R})^2}{T - 1}}$$

- the frequency distribution of the returns (see next slide).

U.S. Historical Returns, 1926-1999

Series	Average Annual Return	Standard Deviation	Distribution
Large Company Stocks	13.0%	20.1%	
Small Company Stocks	17.7	33.9	
Long-Term Corporate Bonds	6.1	8.7	
Long-Term Government Bonds	5.6	9.2	
U.S. Treasury Bills	3.8	3.2	
Inflation	3.2	4.5	



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5.0 RISK

A. ALONG WITH RETURN COMES RISK:

==>Security returns are examples of random variables -

- Random variables are typically characterized by their probability distributions
- i.e., a function that relates the potential values of the random variable to their associated probabilities along with measures of their:
- central tendency - MEAN RETURN and
- dispersion - VARIANCE OR STD. DEVIATION.

B. Risk Premiums

- Define: T-bill rate as the risk-free return
  & common stocks as an average risk,
- Excess return: the difference between an average risk return and returns on T-bills.
- Risk premium - reward for bearing risk,

= risky investment return - risk-free rate.

C. The First Lesson of Risk and Return

==>Risky investments earn a risk-premium. For common stocks the average risk premium has been 9.2% (historically through 1999).

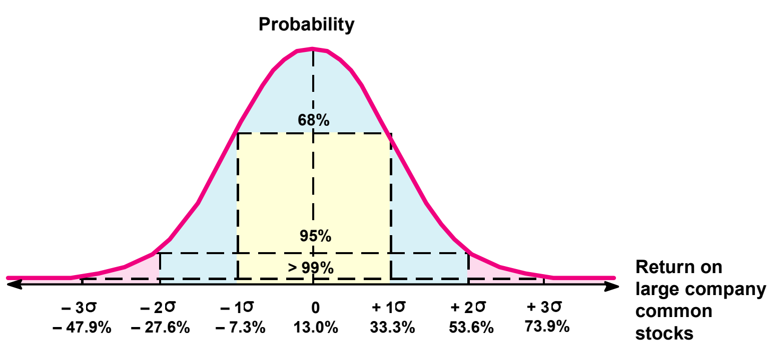
6.0 The VARIABILITY OF RETURNS

A. The Historical Variance and Standard Deviation

- Historical returns constitute a sample, so sample statistics are in order.
- Variance - The average squared deviation between actual returns and their mean.
- VAR (r) $= s^2 = \dfrac{\sum_{t=1}^{T} (r_{it} - \bar{r}_i)^2}{T - 1}$
- Standard deviation is simply the square root of the variance. Its interpretation is facilitated by a discussion of the normal distribution.

Normal Distribution

A large enough sample drawn from a normal distribution looks like a bell-shaped curve.



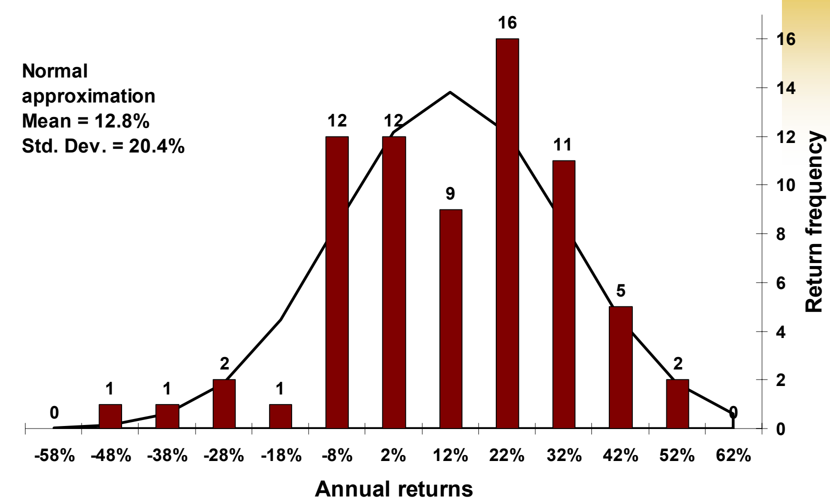
the probability that a yearly return will fall within 20.1 percent of the mean of 13.3 percent will be approximately 2/3.

Normal Distribution

The 20.1-percent standard deviation we found for stock returns from 1926 through 1999 can now be interpreted in the following way: if stock returns are approximately normally distributed, the probability that a yearly return will fall within 20.1 percent of the mean of 13.3 percent will be approximately 2/3.

Normal Distribution

S&P 500 Return Frequencies



C. The Second Lesson of Risk and Return:

- Based upon the mans and variances of securities' historical returns, the second lesson is:
- The greater the potential reward, the greater is the risk.

7.0 SUMMARY AND CONCLUSIONS

- We are interested in EXPECTED RETURNS
  "Adjust" History for Expected Risk and Level of Risk Premium.
- The higher the Risk the higher the Expected Return
- Remember - Expected Returns are Never Realized.