Capital Market Theory

Return & Risk Calculations, Risk Premiums, and Historical Averages
Returns

Dollar Returns have 2 components:

- **Income Component**: Direct cash payments (e.g., dividends or interest)
- **Price Change**: Capital gain or loss
  - Whether realized or unrealized, capital gain/loss is always part of the total return

Percentage Return:

\[
R_t = \frac{D_{t+1}}{P_t} + \frac{(P_{t+1} - P_t)}{P_t}
\]
Average and Holding Period Returns

Average or Mean returns: $\sum R_t / T$
- Arithmetic mean; Intuitive

Average annual return for 1991 - 2003: 13.53%

Holding period returns:

$$[\frac{(1+R_1) * (1+R_2) * (1+R_3) * \ldots * (1+R_T)}{1}] - 1$$

$HPR_{1991 - 2003} = 4.32175 - 1 = 332.175\%$

$100,000$ invested on 1/1/91 would have grown to $432,175$ on 12/31/03
Geometric Mean Returns

Geometric Mean returns (superior):

\[(1+R_1) \times (1+R_2) \times (1+R_3) \times \ldots \times (1+R_T)^{(1/T)} - 1\]

\text{G.M.}_{1991-2003} = (4.32175)^{1/13} - 1 = 11.92\%

\text{HPR}_{1991-1999} = 5.48006 - 1 = 448.01\%

$100,000$ invested on 1/1/91 would have grown to $548,006$ on 12/31/99

\text{G.M.}_{1991-1999} = (5.48006)^{1/9} - 1 = 20.81\%
Risk

$\text{Variance} = \sigma^2 = \sum (R_t - R)^2 / (T-1)$

$\text{Variance}_{1991-2003} = 0.0475$

$\text{S.D.}_{1991-2003} = 0.2179$

Normal distribution
Average Returns and Risk Premiums (Historical)

- **Risk Premium** = *excess return* = return on an asset - risk-free return
- **Real Return** = Nominal Return (GM) - Inflation

- *99 years* of investing in T-Bills (@0.7%) to double one’s REAL wealth
  - *Only 9.6 years* (@7.5%) of stock investment
The Future Value of an Investment of $1 in 1925

The Future Value of an Investment of $1 in 1926

\[ \$1 \times (1 + r_{1926}) \times (1 + r_{1927}) \times \cdots \times (1 + r_{1999}) = \$2,845.63 \]

### Historical Returns, 1926-2002

<table>
<thead>
<tr>
<th>Series</th>
<th>Average Annual Return</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Company Stocks</td>
<td>12.2%</td>
<td>20.5%</td>
</tr>
<tr>
<td>Small Company Stocks</td>
<td>16.9</td>
<td>33.2</td>
</tr>
<tr>
<td>Long-Term Corporate Bonds</td>
<td>6.2</td>
<td>8.7</td>
</tr>
<tr>
<td>Long-Term Government Bonds</td>
<td>5.8</td>
<td>9.4</td>
</tr>
<tr>
<td>U.S. Treasury Bills</td>
<td>3.8</td>
<td>3.2</td>
</tr>
<tr>
<td>Inflation</td>
<td>3.1</td>
<td>4.4</td>
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## Historical Returns, 1926-1999

### Average Annual Return

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<tr>
<td>Large Company Stocks</td>
<td>13.0%</td>
<td>20.3%</td>
</tr>
<tr>
<td>Small Company Stocks</td>
<td>17.7%</td>
<td>33.9%</td>
</tr>
<tr>
<td>Long-Term Corporate Bonds</td>
<td>6.1%</td>
<td>8.7%</td>
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<td>Long-Term Government Bonds</td>
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<td>9.2%</td>
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The Risk-Return Tradeoff

Annual Return Standard Deviation vs Annual Return Average

- T-Bills
- T-Bonds
- Large-Company Stocks
- Small-Company Stocks
Rates of Return 1926-2002

Stock Market Volatility

The volatility of stocks is not constant from year to year.

Small-Cap Effect?

$1  1926-1996  excluding 1974-1983
Large  $1,370  $368
Small  $3,990  $263

Is the whole “small-cap” effect a result of a “freakish” 9-year period?

What about risk of small-caps??

Can you eliminate that by diversification?

H.W. 2, 4, 6-9, 12, 14, 16, 19