Section 3 - Measuring Investment Risk

- Standard Deviation
- Eliminating Idiosyncratic Risk
- Sharpe Ratio
- Security Market Line
- Alpha
- Beta
Using the Past to help **Guess** the Future

There are no guarantees or absolutes with stocks and most aspects about their future are uncertain. Therefore, we have to talk about “Expected Returns” in terms of probabilities.

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**S&P Returns Distribution from 1997 to 08**

- **Average**: 6.71%
- **Std. Dev**: 18.21%
- **APR**: 5.24%

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Number of Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3σ to -11.5%</td>
<td>0.1%</td>
</tr>
<tr>
<td>-11.5% to 6.71%</td>
<td>13.0%</td>
</tr>
<tr>
<td>6.71% to 24.92%</td>
<td>34.1%</td>
</tr>
<tr>
<td>24.92% to 43.13%</td>
<td>34.1%</td>
</tr>
<tr>
<td>43.13% to 3σ</td>
<td>2.1%</td>
</tr>
</tbody>
</table>

Lower limit = average - (standard deviation)
Upper limit = average + (standard deviation)

**Example**
- 68% of the time between -12% and 25%
- 95% of the time between -30% and 43%
Standard Deviation for S&P 1997 to 08

**Average Return**
- 6.71%

**Std. Dev**
- 18.21%

Range of returns and probabilities of getting those returns
In any given year

**Risk**
- -29.7%
- -11.5%
- 6.71%

13.6% chance

2.5% chance

Diversification - getting rid of unique risk

Total Risk

Unique Risk

σ ~ 27%

U.S. Stocks

Systematic Risk

σ ~ 12%

U.S. and International Stocks

Portfolio Size

Diversification - Example

<table>
<thead>
<tr>
<th>Date</th>
<th>S&amp;P</th>
<th>S&amp;P Return</th>
<th>EAFE</th>
<th>EAFE Return</th>
<th>S&amp;P + EAFE</th>
<th>S&amp;P + EAFE Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/31/08</td>
<td>1378.55</td>
<td>-4.15%</td>
<td>2044.11</td>
<td>-2.09%</td>
<td>1711.33</td>
<td>-2.93%</td>
</tr>
<tr>
<td>1/31/07</td>
<td>1438.24</td>
<td>12.36%</td>
<td>2087.67</td>
<td>17.12%</td>
<td>1762.96</td>
<td>15.13%</td>
</tr>
<tr>
<td>1/31/06</td>
<td>1280.08</td>
<td>8.36%</td>
<td>1782.57</td>
<td>19.88%</td>
<td>1531.33</td>
<td>14.78%</td>
</tr>
<tr>
<td>1/31/05</td>
<td>1181.27</td>
<td>4.43%</td>
<td>1486.97</td>
<td>13.82%</td>
<td>1334.12</td>
<td>9.46%</td>
</tr>
<tr>
<td>1/30/04</td>
<td>1131.13</td>
<td>32.19%</td>
<td>1306.42</td>
<td>43.19%</td>
<td>1218.78</td>
<td>37.86%</td>
</tr>
<tr>
<td>1/31/03</td>
<td>855.7</td>
<td>-24.29%</td>
<td>912.38</td>
<td>-16.53%</td>
<td>884.04</td>
<td>-20.48%</td>
</tr>
<tr>
<td>1/31/02</td>
<td>1130.2</td>
<td>-17.26%</td>
<td>1093.11</td>
<td>-26.70%</td>
<td>1111.66</td>
<td>-22.19%</td>
</tr>
<tr>
<td>1/31/01</td>
<td>1366.01</td>
<td>-2.04%</td>
<td>1491.29</td>
<td>-9.43%</td>
<td>1428.65</td>
<td>-6.04%</td>
</tr>
<tr>
<td>1/31/00</td>
<td>1394.46</td>
<td>8.97%</td>
<td>1646.62</td>
<td>17.68%</td>
<td>1520.54</td>
<td>13.52%</td>
</tr>
<tr>
<td>1/29/99</td>
<td>1279.64</td>
<td>30.54%</td>
<td>1399.24</td>
<td>12.73%</td>
<td>1339.44</td>
<td>20.59%</td>
</tr>
<tr>
<td>1/30/98</td>
<td>980.28</td>
<td>24.69%</td>
<td>1241.20</td>
<td>8.63%</td>
<td>1110.74</td>
<td>15.18%</td>
</tr>
<tr>
<td>1/31/97</td>
<td>786.16</td>
<td></td>
<td>1142.57</td>
<td></td>
<td>964.37</td>
<td></td>
</tr>
</tbody>
</table>

Average Return: 6.71% 7.12% 6.81%
APR: 5.24% 5.43% 5.35%
Std. Dev: 18.21% 19.53% 18.04%

Combining S&P and EAFE gives more return than S&P with lower risk.

Argument for Diversification

Do you believe that the Financials sector will continue to grow?

Can you tell me which companies in that sector will survive?

*Example: Bear Sterns (BSC), (XLF)
Sharpe Ratio

\[ \text{Sharpe Ratio} = \frac{\text{Return} - \text{Risk Free Rate}}{\text{Standard Deviation}} \]

Shows how much return premium we are getting per unit of risk.

A way to compare investments.

<table>
<thead>
<tr>
<th>Fund</th>
<th>JP Morgan Intl Equity</th>
<th>Oppenheimer Intl Gr</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 YR Return</td>
<td>8.46%</td>
<td>9.89%</td>
</tr>
<tr>
<td>10 YR STD</td>
<td>15.37%</td>
<td>21.79%</td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>.32</td>
<td>.29</td>
</tr>
</tbody>
</table>

The extra return is not commensurate with the added volatility

* Yahoo example

Security Market Line and Alpha

Volatility of the market (use S&P as proxy)

return

5% (risk free rate)

Risk Premia

volatility

Security Market Line, Beta and Alpha

β = systematic risk, aka Market Risk

Fund Examples: http://www.wsj.com