Beta Stability: Is It Recession Proof?

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What is Beta?

- Beta measures the risk associated with a security
- Relative statistic
- Modeling
- Formal Definition: The covariance of a portfolio and the market relative to the variance of the market.
What is Beta?

- Mathematical Representation:
  \[ \beta = \frac{\text{Cov}_{pm}}{\sigma_m^2} \]
  
  Where the components can be expressed as:

  \[ \text{Cov}_{pm} = \frac{\sum_{t=1}^{n}(R_{pt} - \bar{R}_p)(R_{mt} - \bar{R}_m)}{n-1} \quad 	ext{and} \quad \sigma_m^2 = \frac{\sum_{t=1}^{n}(R_{mt} - \bar{R}_m)^2}{n-1} \]
What is Beta?

- Example:
  - Portfolio Beta = 2
  - 10% market increase → 20% portfolio increase.
  - 10% market decrease → 20% portfolio decrease.

- What if Beta = 1 or 0.5?
Project Goal

- To determine the effect that the state of the economy has on beta stability of a portfolio.
Dow Jones Industrial Average

![Graph of Dow Jones Industrial Average]
Methodology

- Isolate two time periods
  - Recessionary
    - National Bureau of Economic Research
  - Expansionary

<table>
<thead>
<tr>
<th>Normal Expansionary Period</th>
<th>Recessionary Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/1/05  2/1/06</td>
<td>10/1/07  12/1/07</td>
</tr>
<tr>
<td></td>
<td>8/1/09</td>
</tr>
</tbody>
</table>
Dow Jones Industrial Average

Normal Economic Growth
Dow Jones Industrial Average
Methodology

- Create three portfolios:
  1. Diversified
     - Variety of sectors and industries
     - $B = 1$
  2. Leisure
     - Cruise, resort, casino
     - $B > 1$
  3. Necessities
     - Staple foods, supermarkets, utilities
     - $B < 1$
Methodology

- Calculate betas throughout the normal economic growth period and the recessionary period.
  \[ \beta = \frac{\text{Cov}_{pm}}{\sigma_m^2} \]
- Calculate the standard deviation of the betas in each time period.
- Test to see if there is a statistically significant change in the standard deviation.
  - F-test at 5% significance level
Results

Diversified Beta

Beta

Time

Results

Leisure Beta

Time

Beta

0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0


Leisure Beta
Results

Necessity Beta

![Graph showing Necessity Beta over time from 12/14/2005 to 10/14/2009. The graph displays fluctuations in Beta values with specific dates marked for reference.]
Results

Diversified, Leisure, and Necessity Beta

<table>
<thead>
<tr>
<th>Time</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/14/2005</td>
<td>0.4</td>
</tr>
<tr>
<td>7/2/2006</td>
<td>0.6</td>
</tr>
<tr>
<td>1/18/2007</td>
<td>0.8</td>
</tr>
<tr>
<td>8/6/2007</td>
<td>1.0</td>
</tr>
<tr>
<td>2/22/2008</td>
<td>1.2</td>
</tr>
<tr>
<td>9/9/2008</td>
<td>1.4</td>
</tr>
<tr>
<td>3/28/2009</td>
<td>1.6</td>
</tr>
<tr>
<td>10/14/2009</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Diversified Beta, Leisure Beta, Necessity Beta
### Results

<table>
<thead>
<tr>
<th>Portfolio Type</th>
<th>Normal Economic Growth</th>
<th>Recession</th>
<th>F-Test</th>
<th>T-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta Mean</td>
<td>Standard Deviation</td>
<td>Variance</td>
<td>Beta Mean</td>
</tr>
<tr>
<td>Diversified</td>
<td>0.88</td>
<td>0.0472</td>
<td>0.0022</td>
<td>0.94</td>
</tr>
<tr>
<td>Leisure</td>
<td>1.11</td>
<td>0.2793</td>
<td>0.0780</td>
<td>1.17</td>
</tr>
<tr>
<td>Necessities</td>
<td>0.71</td>
<td>0.1100</td>
<td>0.0121</td>
<td>0.66</td>
</tr>
</tbody>
</table>
Results

Diversified, Leisure, and Necessity Beta

Diversified Beta
Leisure Beta
Necessity Beta
Conclusions

- None of the portfolios had statistically significant change in the standard deviation during the recession.
- The recession did not effect beta stability at the 5% significance level.
- High volatility regardless of the state of the economy.

\[ \beta = \frac{\text{Cov}_{pm}}{\sigma_{m}^{2}} \]
Discussion

Leisure Beta

Beta

Time

Discussion

- Beta stability assumption does not consistently hold.
- Financial practitioners need to calculate high-risk portfolio betas frequently.
- Two characteristics identified for beta stability:
  - Diversification
  - Low average beta
Discussion

Diversified, Leisure, and Necessities Beta

Beta

Time


Diversified Beta
Leisure Beta
Necessity Beta
Discussion

Further Study:
- Find more determinants of beta stability
- Show statistical significance

- Keep track of your portfolio beta!
Bibliography