Chapter 12

Return, Risk, and the Security Market Line
Return, Risk, and the Security Market Line

• Our goal in this chapter is to define risk more precisely, and discuss how to measure it.

• In addition, we will quantify the relation between risk and return in financial markets.
Expected and Unexpected Returns

• The return on any stock traded in a financial market is composed of two parts.
  - The normal, or expected, part of the return is the return that investors predict or expect.
  - The uncertain, or risky, part of the return comes from unexpected information revealed during the year.

\[
\text{Total Return} = \text{Expected Return} + \text{Unexpected Return}
\]

\[
\text{Unexpected Return} = \text{Total Return} - \text{Expected Return}
\]

\[
U = R - E(R)
\]
Announcements and News

• Firms make periodic announcements about events that may significantly impact the profits of the firm.
  – Earnings
  – Product development
  – Personnel

• The impact of an announcement depends on how much of the announcement represents new information.
  – When the situation is not as bad as previously thought, what seems to be bad news is actually good news.
  – When the situation is not as good as previously thought, what seems to be good news is actually bad news.

• News about the future is what really matters.
  – Market participants factor predictions about the future into the expected part of the stock return.
  – Announcement = Expected News + Surprise News
Systematic and Unsystematic Risk

- **Systematic risk** is risk that influences a large number of assets. Also called *market risk*.

- **Unsystematic risk** is risk that influences a single company or a small group of companies. Also called *unique risk* or *firm-specific risk*.

**Total risk = Systematic risk + Unsystematic risk**
Systematic and Unsystematic Components of Return

- Recall:

\[ R - E(R) = U \]

= Systematic portion + Unsystematic portion

= \( m + \varepsilon \)

\[ R - E(R) = m + \varepsilon \]
Diversification and Risk

• In a large portfolio:
  – Some stocks will go up in value because of positive company-specific events, while
  – Others will go down in value because of negative company-specific events.

• Unsystematic risk is essentially eliminated by diversification, so a portfolio with many assets has almost no unsystematic risk.

• **Unsystematic** risk is also called *diversifiable* risk.

• **Systematic** risk is also called *non-diversifiable* risk.
The Systematic Risk Principle

• What determines the size of the risk premium on a risky asset?

• The systematic risk principle states:

  *The expected return on an asset depends only on its systematic risk.*

• So, no matter how much total risk an asset has, only the *systematic* portion is relevant in determining the expected return (and the risk premium) on that asset.
Measuring Systematic Risk

• To be compensated for risk, the risk has to be special.
  – Unsystematic risk is not special.
  – Systematic risk is special.

• The Beta coefficient ($\beta$) measures the relative systematic risk of an asset.
  – Assets with Betas larger than 1.0 have more systematic risk than average.
  – Assets with Betas smaller than 1.0 have less systematic risk than average.

• Because assets with larger betas have greater systematic risks, they will have greater expected returns.

*Note that not all Betas are created equally.*
Published Beta Coefficients

**TABLE 12.1 Beta Coefficients**

<table>
<thead>
<tr>
<th>Company</th>
<th>Value Line</th>
<th>Beta, β</th>
<th>Standard and Poor’s</th>
</tr>
</thead>
<tbody>
<tr>
<td>ExxonMobil</td>
<td>0.80</td>
<td></td>
<td>0.40</td>
</tr>
<tr>
<td>IBM</td>
<td>1.05</td>
<td></td>
<td>1.58</td>
</tr>
<tr>
<td>Starbucks</td>
<td>0.80</td>
<td></td>
<td>0.46</td>
</tr>
<tr>
<td>Wal-Mart</td>
<td>0.90</td>
<td></td>
<td>0.67</td>
</tr>
<tr>
<td>General Motors</td>
<td>1.25</td>
<td></td>
<td>1.18</td>
</tr>
<tr>
<td>Microsoft</td>
<td>1.15</td>
<td></td>
<td>1.65</td>
</tr>
<tr>
<td>Harley-Davidson</td>
<td>1.10</td>
<td></td>
<td>1.06</td>
</tr>
<tr>
<td>eBay</td>
<td>1.45</td>
<td></td>
<td>1.75</td>
</tr>
<tr>
<td>Nordstrom</td>
<td>1.20</td>
<td></td>
<td>1.67</td>
</tr>
</tbody>
</table>

Sources: Value Line Investment Survey and S&P Stock Reports.
# Finding a Beta on the Web

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>Stock Price History</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiscal Year Ends:</td>
<td>Beta: 3.385</td>
</tr>
<tr>
<td>Most Recent Quarter (mrq):</td>
<td>52-Week Change: N/A</td>
</tr>
<tr>
<td></td>
<td>S&amp;P500 52-Week Change: 6.01%</td>
</tr>
<tr>
<td><strong>Profitability</strong></td>
<td>52-Week High (28-Oct-05): 23.90</td>
</tr>
<tr>
<td>Profit Margin (ttm):</td>
<td>52-Week Low (29-Sep-05): 20.10</td>
</tr>
<tr>
<td>Operating Margin (ttm):</td>
<td>50-Day Moving Average: 21.94</td>
</tr>
<tr>
<td></td>
<td>200-Day Moving Average: 21.94</td>
</tr>
<tr>
<td><strong>Management Effectiveness</strong></td>
<td><strong>Share Statistics</strong></td>
</tr>
<tr>
<td>Return on Assets (ttm):</td>
<td>Average Volume (3 month): 1,031,550</td>
</tr>
<tr>
<td>Return on Equity (ttm):</td>
<td>Average Volume (10 day): 809,912</td>
</tr>
<tr>
<td></td>
<td>Shares Outstanding: 36.10M</td>
</tr>
<tr>
<td><strong>Income Statement</strong></td>
<td>Float: 33.97M</td>
</tr>
<tr>
<td>Revenue (ttm):</td>
<td>% Held by Insiders: 21.46%</td>
</tr>
<tr>
<td>Revenue Per Share (ttm):</td>
<td>% Held by Institutions: 2.20%</td>
</tr>
<tr>
<td>Qtrly Revenue Growth (yoy):</td>
<td>Shares Short (as of 11-Oct-05): 5.93M</td>
</tr>
<tr>
<td>Gross Profit (ttm):</td>
<td>Short Ratio (as of 11-Oct-05): 3.7</td>
</tr>
<tr>
<td>EBITDA (ttm):</td>
<td>Short % of Float (as of 11-Oct-05): 177.60%</td>
</tr>
<tr>
<td>Net Income Avl to Common (ttm):</td>
<td>Shares Short (prior month): 0</td>
</tr>
<tr>
<td>Diluted EPS (ttm):</td>
<td></td>
</tr>
<tr>
<td>Qtrly Earnings Growth (yoy):</td>
<td></td>
</tr>
</tbody>
</table>
Portfolio Betas

- The total risk of a portfolio has no simple relation to the total risk of the assets in the portfolio.
  - Recall the variance of a portfolio equation
  - For two assets, you need two variances and the covariance.
  - For four assets, you need four variances, and six covariances.

- In contrast, a portfolio Beta can be calculated just like the expected return of a portfolio.
  - That is, you can multiply each asset’s Beta by its portfolio weight and then add the results to get the portfolio’s Beta.
Example: Calculating a Portfolio Beta

- Using data from Table 12.1, we see
  - Beta for IBM is 1.05
  - Beta for eBay is 1.45

- You put half your money into IBM and half into eBay.

- What is your portfolio Beta?

\[
\beta_p = .50 \times \beta_{\text{IBM}} + .50 \times \beta_{\text{eBay}}
\]

\[
= .50 \times 1.05 + .50 \times 1.45
\]

\[
= 1.25
\]
Beta and the Risk Premium, I.

- Consider a portfolio made up of asset A and a risk-free asset.
  - For asset A, $E(R_A) = 16\%$ and $\beta_A = 1.6$
  - The risk-free rate $R_f = 4\%$. Note that for a risk-free asset, $\beta = 0$ by definition.

- We can calculate some different possible portfolio expected returns and betas by changing the percentages invested in these two assets.

- Note that if the investor borrows at the risk-free rate and invests the proceeds in asset A, the investment in asset A will exceed 100\%.
Beta and the Risk Premium, II.

<table>
<thead>
<tr>
<th>% of Portfolio in Asset A</th>
<th>Portfolio Expected Return</th>
<th>Portfolio Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>4</td>
<td>0.0</td>
</tr>
<tr>
<td>25</td>
<td>7</td>
<td>0.4</td>
</tr>
<tr>
<td>50</td>
<td>10</td>
<td>0.8</td>
</tr>
<tr>
<td>75</td>
<td>13</td>
<td>1.2</td>
</tr>
<tr>
<td>100</td>
<td>16</td>
<td>1.6</td>
</tr>
<tr>
<td>125</td>
<td>19</td>
<td>2.0</td>
</tr>
<tr>
<td>150</td>
<td>22</td>
<td>2.4</td>
</tr>
</tbody>
</table>
Portfolio Expected Returns and Betas for Asset A

A. Portfolio expected returns and betas for Asset A

- \( E(R_A) = 16\% \)
- \( R_f = 4\% \)
- \( 1.6 = \beta_A \)
- \( \frac{E(R_A) - R_f}{\beta_A} = 7.5\% \)
The Reward-to-Risk Ratio

- Notice that all the combinations of portfolio expected returns and betas fall on a straight line.

- Slope (Rise over Run):

\[
\frac{E(R_A) - R_f}{\beta_A} = \frac{16\% - 4\%}{1.6} = 7.50\%
\]

- What this tells us is that asset A offers a reward-to-risk ratio of 7.50%. In other words, asset A has a risk premium of 7.50% per “unit” of systematic risk.
• Recall that for asset A: $E(R_A) = 16\%$ and $\beta_A = 1.6$

• Suppose there is a second asset, asset B.

• For asset B: $E(R_B) = 12\%$ and $\beta_A = 1.2$

• Which investment is better, asset A or asset B?
  – Asset A has a higher expected return
  – Asset B has a lower systematic risk measure
The Basic Argument, II

As before with Asset A, we can calculate some different possible portfolio expected returns and betas by changing the percentages invested in asset B and the risk-free rate.

<table>
<thead>
<tr>
<th>% of Portfolio in Asset B</th>
<th>Portfolio Expected Return</th>
<th>Portfolio Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>4</td>
<td>0.0</td>
</tr>
<tr>
<td>25</td>
<td>6</td>
<td>0.3</td>
</tr>
<tr>
<td>50</td>
<td>8</td>
<td>0.6</td>
</tr>
<tr>
<td>75</td>
<td>10</td>
<td>0.9</td>
</tr>
<tr>
<td>100</td>
<td>12</td>
<td>1.2</td>
</tr>
<tr>
<td>125</td>
<td>14</td>
<td>1.5</td>
</tr>
<tr>
<td>150</td>
<td>16</td>
<td>1.8</td>
</tr>
</tbody>
</table>
B. Portfolio expected returns and betas for Asset B

Portfolio expected return ($E(R_p)$)

$E(R_B) = 12\%$

$R_f = 4\%$

$1.2 = \beta_B$

Portfolio beta ($\beta_p$)

$\frac{E(R_B) - R_f}{\beta_B} = 6.67\%$
Portfolio Expected Returns and Betas for Both Assets

C. Portfolio expected returns and betas for both assets

Portfolio expected return ($E(R_p)$)

- $E(R_A) = 16\%$
- $E(R_B) = 12\%$
- $R_f = 4\%$

Asset A
- = 7.50\%

Asset B
- = 6.67\%

Portfolio beta ($\beta_p$)

- $1.2 = \beta_B$
- $1.6 = \beta_A$
The Fundamental Result, I.

• The situation we have described for assets A and B cannot persist in a well-organized, active market
  – Investors will be attracted to asset A (and buy A shares)
  – Investors will shy away from asset B (and sell B shares)

• This buying and selling will make
  – The price of A shares increase
  – The price of B shares decrease

• This price adjustment continues until the two assets plot on exactly the same line.

• That is, until:
  \[ \frac{\mathbb{E}(R_A) - R_f}{\beta_A} = \frac{\mathbb{E}(R_B) - R_f}{\beta_B} \]
The Fundamental Result, II.

In general …

• The reward-to-risk ratio must be the same for all assets in a competitive financial market.

• If one asset has twice as much systematic risk as another asset, its risk premium will simply be twice as large.

• Because the reward-to-risk ratio must be the same, all assets in the market must plot on the same line.
The fundamental relationship between beta and expected return is that all assets must have the same reward-to-risk ratio, \( \frac{E(R_i) - R_f}{\beta_i} \). This means that they would all plot on the same straight line. Assets A and B are examples of this behavior. Asset C’s expected return is too high; Asset D’s is too low.
The Security Market Line (SML)

- The **Security market line (SML)** is a graphical representation of the linear relationship between systematic risk and **expected** return in financial markets.

- For a market portfolio,

\[
\beta_M \frac{E(R_M) - R_f}{1} = \frac{E(R_M) - R_f}{1} = E(R_M) - R_f
\]
The Security Market Line, II.

• The term $E(R_M) - R_f$ is often called the **market risk premium** because it is the risk premium on a market portfolio.

• For any asset $i$ in the market:

$$\frac{E(R_i) - R_f}{\beta_i} = E(R_M) - R_f$$

$$\Rightarrow E(R_i) = R_f + \left[E(R_M) - R_f\right] \times \beta_i$$

• Setting the reward-to-risk ratio for all assets equal to the market risk premium results in an equation known as the **capital asset pricing model**.
The Security Market Line, III.

- The **Capital Asset Pricing Model (CAPM)** is a theory of risk and return for securities on a competitive capital market.

\[
E(R_i) = R_f + \left[ E(R_M) - R_f \right] \times \beta_i
\]

- The CAPM shows that \( E(R_i) \) depends on:
  - \( R_f \), the pure time value of money.
  - \( E(R_M) - R_f \), the reward for bearing systematic risk.
  - \( \beta_i \), the amount of systematic risk.
The Security Market Line, IV.

**FIGURE 12.3 Security Market Line (SML)**

The slope of the security market line is equal to the market risk premium, i.e., the reward for bearing an average amount of systematic risk. The equation describing the SML can be written as:

\[ E(R_i) = R_f + [E(R_M) - R_f] \times \beta_i \]

which is the capital asset pricing model (CAPM).
### TABLE 12.2 Risk and Return Summary

1. **Total risk.** The *total risk* of an investment is measured by the variance or, more commonly, the standard deviation of its return.

2. **Total return.** The *total return* on an investment has two components: the expected return and the unexpected return. The unexpected return comes about because of unanticipated events. The risk from investing stems from the possibility of an unanticipated event.

3. **Systematic and unsystematic risks.** *Systematic risks* (also called *market risks*) are unanticipated events that affect almost all assets to some degree because the effects are economywide. *Unsystematic risks* are unanticipated events that affect single assets or small groups of assets. Unsystematic risks are also called *unique* or *asset-specific risks.*

4. **The effect of diversification.** Some, but not all, of the risk associated with a risky investment can be eliminated by diversification. The reason is that unsystematic risks, which are unique to individual assets, tend to wash out in a large portfolio, but systematic risks, which affect all of the assets in a portfolio to some extent, do not.

5. **The systematic risk principle and beta.** Because unsystematic risk can be freely eliminated by diversification, the *systematic risk principle* states that the reward for bearing risk depends only on the level of systematic risk. The level of systematic risk in a particular asset, relative to the average, is given by the *beta* of that asset.
6. The reward-to-risk ratio and the security market line. The reward-to-risk ratio for Asset $i$ is the ratio of its risk premium, $E(R_i) - R_f$, to its beta, $\beta_i$.

$$\frac{E(R_i) - R_f}{\beta_i}$$

In a well-functioning market, this ratio is the same for every asset. As a result, when asset expected returns are plotted against asset betas, all assets plot on the same straight line, called the security market line (SML).

7. The capital asset pricing model. From the SML, the expected return on Asset $i$ can be written:

$$E(R_i) = R_f + [E(R_M) - R_f] \times \beta_i$$

This is the capital asset pricing model (CAPM). The expected return on a risky asset thus has three components. The first is the pure time value of money ($R_f$); the second is the market risk premium, $E(R_M) - R_f$; and the third is the beta for the asset ($\beta_i$).
A Closer Look at Beta

- \( R - E(R) = m + \varepsilon \), where \( m \) is the systematic portion of the unexpected return.

- \( m = \beta \times [R_M - E(R_M)] \)

- So, \( R - E(R) = \beta \times [R_M - E(R_M)] + \varepsilon \)

- In other words:
  - A high-Beta security is simply one that is relatively sensitive to overall market movements
  - A low-Beta security is one that is relatively insensitive to overall market movements.
## Decomposition of Total Returns

### TABLE 12.3  Decomposition of Total Returns into Systematic and Unsystematic Portions

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Returns</th>
<th>Unexpected Returns</th>
<th>Systematic Portion</th>
<th>Unsystematic Portion ($\epsilon$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$R$</td>
<td>$R_M$</td>
<td>$R - E(R)$</td>
<td>$R_M - E(R_M)$</td>
</tr>
<tr>
<td>2001</td>
<td>20%</td>
<td>15%</td>
<td>6.6%</td>
<td>3%</td>
</tr>
<tr>
<td>2002</td>
<td>-24.6</td>
<td>-3</td>
<td>-38</td>
<td>-15</td>
</tr>
<tr>
<td>2003</td>
<td>23</td>
<td>10</td>
<td>9.6</td>
<td>-2</td>
</tr>
<tr>
<td>2004</td>
<td>36.8</td>
<td>24</td>
<td>23.4</td>
<td>12</td>
</tr>
<tr>
<td>2005</td>
<td>3.4</td>
<td>7</td>
<td>-10</td>
<td>-5</td>
</tr>
</tbody>
</table>
Unexpected Returns and Beta

**FIGURE 12.4** Unexpected Returns and Beta

- **Y-axis:** Unexpected return on the security (%)
- **X-axis:** Unexpected return on the market (%)

The chart shows the relationship between unexpected returns on a security and the unexpected return on the market for the years 2002 to 2005.

- Blue dots represent the total unexpected return.
- Red squares represent the systematic portion.

Key Years:
- 2002
- 2003
- 2004
- 2005
- 2001
Where Do Betas Come From?

• A security’s Beta depends on:
  – How closely correlated the security’s return is with the overall market’s return, and
  – How volatile the security is relative to the market.

• A security’s Beta is equal to the correlation multiplied by the ratio of the standard deviations.

\[
\beta_i = \text{Corr}(R_i, R_M) \times \frac{\sigma_i}{\sigma_m}
\]
## Where Do Betas Come From?

### TABLE 12.4 Calculating Beta

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>.10</td>
<td>.08</td>
<td>.00</td>
<td>-.04</td>
<td>.0000</td>
<td>.0016</td>
<td>.0000</td>
</tr>
<tr>
<td>2002</td>
<td>-.08</td>
<td>-.12</td>
<td>-.18</td>
<td>-.24</td>
<td>.0324</td>
<td>.0576</td>
<td>.0432</td>
</tr>
<tr>
<td>2003</td>
<td>-.04</td>
<td>.16</td>
<td>-.14</td>
<td>.04</td>
<td>.0196</td>
<td>.0016</td>
<td>-.0056</td>
</tr>
<tr>
<td>2005</td>
<td>.12</td>
<td>.22</td>
<td>.02</td>
<td>.10</td>
<td>.0004</td>
<td>.0100</td>
<td>.0020</td>
</tr>
<tr>
<td>Totals</td>
<td>.50</td>
<td>.60</td>
<td>0</td>
<td>0</td>
<td>.1424</td>
<td>.0904</td>
<td>.0816</td>
</tr>
</tbody>
</table>

### Average Returns, Variances, Standard Deviations

- **Security**
  - Average Return: \( \frac{.50}{5} = .10 = 10\% \)
  - Variance: \( \frac{.1424}{4} = .0356 \)
  - Standard Deviation: \( \sqrt{.0356} = .1887 = 18.87\% \)

- **Market**
  - Average Return: \( \frac{.60}{5} = .12 = 12\% \)
  - Variance: \( \frac{.0904}{4} = .0226 \)
  - Standard Deviation: \( \sqrt{.0226} = .1503 = 15.03\% \)

- Covariance: \( \text{Cov}(R_i, R_m) = .0816/4 = .0204 \)
- Correlation: \( \text{Corr}(R_i, R_m) = .0204/(.1887 \times .1503) = .72 \)
- Beta: \( \beta = .72 \times (.1887/1503) = .9039 \approx .9 \)
Using a Spreadsheet to Calculate Beta

To illustrate how to calculate betas, correlations, and covariances using a spreadsheet, we have entered the information from Table 12.4 into the spreadsheet below. Here, we use Excel functions to do all the calculations.

<table>
<thead>
<tr>
<th></th>
<th>Security</th>
<th>Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>10%</td>
<td>8%</td>
</tr>
<tr>
<td>2002</td>
<td>-8%</td>
<td>-12%</td>
</tr>
<tr>
<td>2003</td>
<td>-4%</td>
<td>16%</td>
</tr>
<tr>
<td>2004</td>
<td>40%</td>
<td>26%</td>
</tr>
<tr>
<td>2005</td>
<td>12%</td>
<td>22%</td>
</tr>
</tbody>
</table>

Average: 10% 12% (Using the =AVERAGE function)
Std. Dev.: 18.87% 15.03% (Using the =STDEV function)
Correlation: 0.72 =CORREL(D10:D14,E10:E14)

Note: The Excel Format is set to percent, but the numbers are entered as decimals.

Excel also has a covariance function, =COVAR, but we do not use it because it divides by n instead of n-1. Verify that you get a Beta of about 0.72 if you use the COVAR function divided by the variance of the Market Returns (Use the Excel function, =VAR).
Why Do Betas Differ?

- Betas are estimated from actual data. Different sources estimate differently, possibly using different data.
  - For data, the most common choices are three to five years of monthly data, or a single year of weekly data.
  - To measure the overall market, the S&P 500 stock market index is commonly used.
  - The calculated betas may be adjusted for various statistical reasons.
Extending CAPM

• The CAPM has a stunning implication:
  – What you earn on your portfolio depends only on the level of systematic risk that you bear
  – As a diversified investor, you do not need to worry about total risk, only systematic risk.

• But, does expected return depend only on Beta? Or, do other factors come into play?

• The above bullet point is a hotly debated question.
Important General Risk-Return Principles

- Investing has two dimensions: risk and return.
- It is inappropriate to look at the total risk of an individual security.
- It is appropriate to look at how an individual security contributes to the risk of the overall portfolio.
- Risk can be decomposed into nonsystematic and systematic risk.
- Investors will be compensated only for systematic risk.
The Fama-French Three-Factor Model

- Professors Gene Fama and Ken French argue that two additional factors should be added.

- In addition to beta, two other factors appear to be useful in explaining the relationship between risk and return.
  - Size, as measured by market capitalization
  - The book value to market value ratio, i.e., B/M

- Whether these two additional factors are truly sources of systematic risk is still being debated.
Returns from 25 Portfolios Formed on Size and Book-to-Market

TABLE 12.5
Average Annual Percentage Returns from 25 Portfolios Formed on Size (Cap) and Book to Market, 1926–2004

<table>
<thead>
<tr>
<th>Quintile</th>
<th>1 (Lowest B/M)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5 (Highest B/M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (smallest cap)</td>
<td>8.42</td>
<td>14.34</td>
<td>18.09</td>
<td>22.06</td>
<td>22.95</td>
</tr>
<tr>
<td>2</td>
<td>11.57</td>
<td>16.20</td>
<td>18.06</td>
<td>19.02</td>
<td>19.76</td>
</tr>
<tr>
<td>3</td>
<td>12.99</td>
<td>15.83</td>
<td>16.48</td>
<td>17.27</td>
<td>18.47</td>
</tr>
<tr>
<td>4</td>
<td>12.44</td>
<td>13.57</td>
<td>15.64</td>
<td>16.51</td>
<td>17.75</td>
</tr>
<tr>
<td>5 (largest cap)</td>
<td>11.64</td>
<td>11.32</td>
<td>12.84</td>
<td>13.29</td>
<td>14.92</td>
</tr>
</tbody>
</table>

Source: Author calculations using data from the Web site of Ken French.

- Note that the portfolio containing the smallest cap and the highest book-to-market have had the highest returns.
Useful Internet Sites

- www.individualinvestor.com (visit the earnings calendar)
- earnings.nasdaq.com (to see recent earnings surprises)
- www.portfolioscience.com (helps you analyze risk)
- www.money.com (another source for betas)
- finance.yahoo.com (a terrific source of financial information)
- www.fenews.com (for information on risk management)
- www.moneychimp.com (for a CAPM calculator)
- http://mba.tuck.dartmouth.edu/pages/faculty/ken/french/ (source for data behind the FAMA-French model)
- www.morningstar.com
- money.cnn.com
- www.hoovers.com
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  – Where do Betas come from?
  – Why do Betas differ?

• Extending CAPM
  – A (very) Brief History of Testing CAPM
  – The Fama-French three-factor model