The Principle of Diversification

- Diversification can substantially reduce the variability of returns without an equivalent reduction in expected returns.
- This reduction in risk arises because worse-than-expected returns from one asset are offset by better-than-expected returns from another asset.
- However, there is a minimum level of risk that cannot be diversified away - that is the systematic portion.

Figure 11.1
Diversifiable Risk

- The risk that can be eliminated by combining assets into a portfolio
- Often considered the same as unsystematic, unique, or asset-specific risk
- If we hold only one asset, or assets in the same industry, then we are exposing ourselves to risk that we could diversify away

Total Risk

- Total risk = systematic risk + unsystematic risk
- The standard deviation of returns is a measure of total risk
- For well-diversified portfolios, unsystematic risk is very small
- Consequently, the total risk for a diversified portfolio is essentially equivalent to the systematic risk
Systematic Risk Principle

• There is a reward for bearing risk
• There is not a reward for bearing risk unnecessarily
• The expected return on a risky asset depends only on that asset’s systematic risk since unsystematic risk can be diversified away

Measuring Systematic Risk

• How do we measure systematic risk?
• We use the beta coefficient to measure systematic risk
• What does beta tell us?
  – A beta of 1 implies the asset has the same systematic risk as the overall market
  – A beta < 1 implies the asset has less systematic risk than the overall market
  – A beta > 1 implies the asset has more systematic risk than the overall market
Table 11.8

<table>
<thead>
<tr>
<th>Company</th>
<th>Beta Coefficient (β)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coca-Cola</td>
<td>.60</td>
</tr>
<tr>
<td>Kellogg</td>
<td>.65</td>
</tr>
<tr>
<td>Papa John’s</td>
<td>.80</td>
</tr>
<tr>
<td>3M</td>
<td>.85</td>
</tr>
<tr>
<td>Home Depot</td>
<td>1.00</td>
</tr>
<tr>
<td>Bed, Bath, and Beyond</td>
<td>1.05</td>
</tr>
<tr>
<td>McDonald’s</td>
<td>1.10</td>
</tr>
<tr>
<td>American Eagle Outfitters</td>
<td>1.35</td>
</tr>
<tr>
<td>Tiffany &amp; Co.</td>
<td>1.55</td>
</tr>
<tr>
<td>Continental Airlines</td>
<td>2.40</td>
</tr>
</tbody>
</table>

Beta coefficients for selected companies


Total versus Systematic Risk

- Consider the following information:

<table>
<thead>
<tr>
<th>Standard Deviation</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security C</td>
<td>20%</td>
</tr>
<tr>
<td>Security K</td>
<td>30%</td>
</tr>
</tbody>
</table>

- Which security has more total risk?
- Which security has more systematic risk?
- Which security should have the higher expected return?
Example: Portfolio Betas

• Consider the previous example with the following four securities
  – Security   Weight  Beta
  – DCLK       .133    4.03
  – KO         .2      0.84
  – INTC       .267    1.05
  – KEI        .4      0.59

• What is the portfolio beta?
  • \[.133(4.03) + .2(0.84) + .267(1.05) + .4(0.59) = 1.22\]

Beta and the Risk Premium

• Remember that the risk premium = expected return – risk-free rate
• The higher the beta, the greater the risk premium should be
• Can we define the relationship between the risk premium and beta so that we can estimate the expected return?
  – YES!
Example: Portfolio Expected Returns and Betas

Market Equilibrium

• In equilibrium, all assets and portfolios must have the same reward-to-risk ratio, and each must equal the reward-to-risk ratio for the market

\[
\frac{E(R_A) - R_f}{\beta_A} = \frac{E(R_M - R_f)}{\beta_M}
\]
Security Market Line

• The security market line (SML) is the representation of market equilibrium
• The slope of the SML is the reward-to-risk ratio: \( \frac{E(R_M) - R_f}{\beta_M} \)
• But since the beta for the market is ALWAYS equal to one, the slope can be rewritten
• Slope = \( E(R_M) - R_f \) = market risk premium

Capital Asset Pricing Model

• The capital asset pricing model (CAPM) defines the relationship between risk and return
• \( E(R_A) = R_f + \beta_A(E(R_M) - R_f) \)
• If we know an asset’s systematic risk, we can use the CAPM to determine its expected return
• This is true whether we are talking about financial assets or physical assets
Factors Affecting Expected Return

- Pure time value of money – measured by the risk-free rate
- Reward for bearing systematic risk – measured by the market risk premium
- Amount of systematic risk – measured by beta

Example: CAPM

- Consider the betas for each of the assets given earlier. If the risk-free rate is 3.15% and the market risk premium is 9.5%, what is the expected return for each?
  - Security | Beta | Expected Return
  - DCLK | 4.03 | 3.15 + 4.03(9.5) = 41.435%
  - KO | 0.84 | 3.15 + .84(9.5) = 11.13%
  - INTC | 1.05 | 3.15 + 1.05(9.5) = 13.125%
  - KEI | 0.59 | 3.15 + .59(9.5) = 8.755%
SML and Equilibrium

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:

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

which is the capital asset pricing model (CAPM).