Diversifiable Risk versus Market Risk

- Most stocks tend to do well when the national economy is strong and badly when it is weak. Thus, even very large portfolios end up with a substantial amount of risk, but not as much risk as if all the money were invested in only one stock.

- In general, the riskiness of a portfolio consisting of large company stocks tends to decline and to approach some limit as the portfolio size increases.
  
  - According to some recent data, the standard deviation of an average one-stock portfolio is 35%. A portfolio consisting of all stocks, which is called the market portfolio, would have a standard deviation of about 20.1%.
  
  - Thus, almost half of the riskiness inherent in an individual stock can be eliminated if the stock is held in a reasonably well diversified portfolio, containing 40 or more stocks in a number of different industries.

- The part of a stock’s risk that can be eliminated is called diversifiable risk, while the part that cannot be eliminated is called market risk.

Concept of Beta and the Capital Asset Pricing Model (CAPM)

- A stock’s relevant risk is measured by how much it contributes to the riskiness of a well-diversified portfolio. Are all stocks equally risky in the sense that adding them to a well-diversified portfolio would have the same effect on the portfolio’s riskiness? The answer is no.

- A stock’s relevant risk is measured by the degree to which a given stock tends to move up or down with the market. This measure is given by the stocks beta

$$b_i = \left( \frac{\sigma_i}{\sigma_M} \right) \rho_{im}$$
where $b_i$ refers to the beta of some stock $i$, $\sigma_i$ is the stand alone standard deviation of this stock, $\sigma_i$ is the standard deviation of the market portfolio, and $\rho_{iM}$ is the correlation of stock return with the return on the market portfolio.

- A stock with $b = 0.5$ is only half as volatile as the market portfolio--it will rise and fall only half as much, whereas a stock with $b = 2$ is twice as volatile as the market portfolio--it will rise and fall twice as much as the market.

**Portfolio Beta:**

- If you have a portfolio with 70% in Stock A (that has $b_A = 1.25$) and 30% in Stock B (that has $b_B = 2$), then the portfolio beta $b_P$ is given by
  
  $$b_P = (0.70)1.25 + (0.30)2 = 1.475$$

- In general, suppose you have a portfolio of $n$ stocks with weights $w_1, w_2, ..., w_n$. Then portfolio beta is given by
  
  $$b_P = w_1 b_1 + w_2 b_2 + ... + w_n b_n.$$

**Security Market Line Equation**

- This equation relates the required return of a stock to the stock’s riskiness, given by the stock’s beta.

  $$r_i = r_{RF} + b_i (r_M - r_{RF})$$

In the above equation,

- $r_i$ : required return on stock $i$.
- $r_{RF}$ : risk free rate.
- $r_M$ : required return on the market portfolio.
- $(r_M - r_{RF})$ is called the market risk premium.