Chapter 11

Risk and Return

Expected Returns

- Expected returns are based on the probabilities of possible outcomes
- In this context, “expected” means average if the process is repeated many times
- The “expected” return does not even have to be a possible return

$$E(R) = \sum_{i=1}^{n} p_i R_i$$

Variance and Standard Deviation

- Variance and standard deviation still measure the volatility of returns
- Using unequal probabilities for the entire range of possibilities
- Weighted average of squared deviations

$$\sigma^2 = \sum_{i=1}^{n} p_i (R_i - E(R))^2$$

Portfolios

- A portfolio is a collection of assets
- An asset’s risk and return is important in how it affects the risk and return of the portfolio
- The risk-return trade-off for a portfolio is measured by the portfolio expected return and standard deviation, just as with individual assets

Portfolio Expected Returns

- The expected return of a portfolio is the weighted average of the expected returns for each asset in the portfolio

$$E(R_P) = \sum_{j=1}^{m} w_j E(R_j)$$

- You can also find the expected return by finding the portfolio return in each possible state and computing the expected value as we did with individual securities

Portfolio Variance

- Compute the portfolio return for each state:
  $R_P = w_1R_1 + w_2R_2 + \ldots + w_mR_m$
- Compute the expected portfolio return using the same formula as for an individual asset
- Compute the portfolio variance and standard deviation using the same formulas as for an individual asset

Expected versus Unexpected Returns

- Realized returns are generally not equal to expected returns
- There is the expected component and the unexpected component
  - At any point in time, the unexpected return can be either positive or negative
  - Over time, the average of the unexpected component is zero

Announcements and News

- Announcements and news contain both an expected component and a surprise component
- It is the surprise component that affects a stock's price and therefore its return
- This is very obvious when we watch how stock prices move when an unexpected announcement is made or earnings are different from anticipated

Efficient Markets

- Efficient markets are a result of investors trading on the unexpected portion of announcements
- The easier it is to trade on surprises, the more efficient markets should be
- Efficient markets involve random price changes because we cannot predict surprises

Systematic Risk

- Risk factors that affect a large number of assets
- Also known as non-diversifiable risk or market risk
- Includes such things as changes in GDP, inflation, interest rates, etc.

Unsystematic Risk

- Risk factors that affect a limited number of assets
- Also known as unique risk and asset-specific risk
- Includes such things as labor strikes, part shortages, etc.

Returns

- Total Return = expected return + unexpected return
- Unexpected return = systematic portion + unsystematic portion
- Therefore, total return can be expressed as follows:
- Total Return = expected return + systematic portion + unsystematic portion

Diversification

- Portfolio diversification is the investment in several different asset classes or sectors
- Diversification is not just holding a lot of assets
- For example, if you own 50 internet stocks, you are not diversified
- However, if you own 50 stocks that span 20 different industries, then you are diversified

Table 11.7

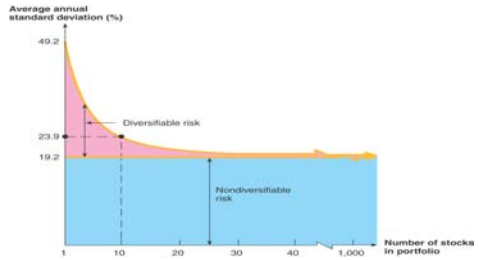
(1) Number of Stocks in Portfolio	(2) Average Standard Deviation of Annual Portfolio Returns	(3) Ratio of Portfolio Standard Deviation to Standard Deviation of a Single Stock
1	49.24%	1.00
2	37.36	.76
4	29.69	.60
6	26.64	.54
8	24.98	.51
10	23.93	.49
20	21.68	.44
30	20.87	.42
40	20.46	.42
50	20.20	.41
100	19.69	.40
200	19.42	.39
300	19.34	.39
400	19.29	.39
500	19.27	.39
1,000	19.21	.39

These figures are from Table 1 in Meir Statman, How Many Stocks Make a Diversified Portfolio? *Journal of Financial and Quantitative Analysis* 22 (September 1987), pp. 353—64They were derived from E. J. Elton and M. J. Gruber, Risk Reduction and Portfolio Size: An Analytic Solution, *Journal of Business* 50 (October 1977), pp. 415—37.

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
- However, there is a minimum level of risk that cannot be diversified away and 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

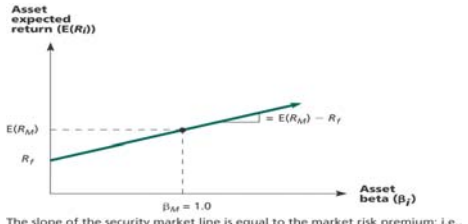
Security Market Line

- The security market line (SML) is the representation of market equilibrium
- The slope of the SML is the reward-to-risk ratio: $(E(R_M) - R_f) / \beta_M$
- 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

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).