Other Return Measures and Their Applications

Gross and Net Returns

Gross returns are calculated before deductions for management expenses, custodial fees, taxes, and other expenses that are not directly linked to the generation of returns. Note that trading expenses (e.g., commissions) are accounted for in the computation of gross returns. Gross returns are an appropriate measure to evaluate portfolio performance.

Net returns deduct all managerial and administrative expenses that reduce an investor's return. Investors are primarily concerned with net returns.

Pre-Tax and After-Tax Nominal Returns

Pre-tax nominal returns do not adjust for taxes or inflation. Unless otherwise stated, always assume that stated returns are pre-tax nominal returns.

After-tax nominal returns account for taxes. Most investors are concerned with returns on an after-tax basis.

Real Returns

Nominal returns consist of the real risk-free rate of return, a premium for risk, and a premium for inflation. Investors calculate the real return because:

- It is useful in comparing returns across time periods as inflation rates may vary over time.
- It is useful in comparing returns among countries when returns are expressed in local currencies in which inflation rates vary between countries.
- The after-tax real return is what an investor receives as compensation for postponing consumption and assuming risk after paying taxes on investment returns.

Real after-tax returns are not usually computed by investment managers because it is difficult to estimate a general tax rate that is applicable to all investors.

Leveraged Return

The leveraged return is computed when an investor uses leverage (by either borrowing money or using derivative contracts) to invest in a security.

Leverage enhances returns, but also magnifies losses. See Example 1-3.

Example 1-3: Computation of Special Returns

Continuing from Example 1-1, suppose that the mutual fund spends a fixed amount of $600,000 every year on expenses that are unrelated to the manager's performance. Given that an investor faces a tax rate of 25% and that the inflation rate is 3%, answer the following questions:

1. What is the annual gross return for the fund in Year 1?
2. What is the after-tax net return for the investor in Year 2? Assume that all gains are realized at the end of the year and that taxes are paid immediately at that time.
3. What is the expected after-tax real return for the investor in Year 5?
4. What is the net return earned by investors in the fund over the 5-year period?

Solution

1. The fixed expenses of $600,000 would cause the gross return to be higher than net return by 1.5% (600,000 / 40,000,000). Therefore, gross return would equal 26.5%(1.5% + 25%).
2. After-tax return (Year 2) = 10% × (1 − 0.25) = 7.5%
3. After-tax return (Year 5) = 20% × (1 − 0.25) = 15%

$$\text{After-tax real return (Year 5)} = \frac{(1+0.15)}{(1+0.03)} - 1 = 1.1165 - 1 = 0.1165 = 11.65\%$$

4. The HPY for the fund over the 5-year period is computed after considering all direct and indirect expenses. The net return is 55.93%.

Variance and Covariance of Returns

The risk of an asset or a portfolio of assets can be measured by its standard deviation, which is the positive square root of variance.

Variance of a Single Asset

Variance equals the average squared deviation of observed values from their mean. A higher variance indicates higher volatility or dispersion of returns. The population variance is calculated as follows:

$$\sigma^2 = \frac{\sum_{t=1}^{T}(R_t - \mu)^2}{T}$$

where:
R_t = Return for the period t
T = Total number of periods
μ = Mean of T returns

If only a representative sample of the population is available, we may calculate the sample variance as:

$$s^2 = \frac{\sum_{t=1}^{T}(R_t - \bar{R})^2}{T-1}$$

where:
$\bar{R}$ = mean return of the sample observations
s^2 = sample variance

Standard Deviation of an Asset

The population and sample standard deviations are calculated as:

$$\sigma = \sqrt{\frac{\sum_{t=1}^{T}(R_t - \mu)^2}{T}} \qquad s = \sqrt{\frac{\sum_{t=1}^{T}(R_t - \bar{R})^2}{T-1}}$$

Variance of a Portfolio of Assets

Earlier in this reading, we learned that the expected return on a portfolio of securities equals the weighted average of the individual securities' returns. However, calculation of portfolio variance and standard deviation is not as straightforward. In addition to being a function of individual asset variances and their weights in the portfolio, portfolio variance also depends on the covariance (and correlation) between the assets in the portfolio. The variance of a two-asset portfolio can be calculated as:

$$\sigma_p^2 = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2\rho_{1,2} \text{ or } w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2Cov_{1,2}$$

The standard deviation of a portfolio of two risky assets is calculated as:

$$\sigma_p = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2\rho_{1,2}} \text{ or } \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2Cov_{1,2}}$$

The first part of the formula for the two-asset portfolio standard deviation ($w_1^2\sigma_1^2 + w_2^2\sigma_2^2$) tells us that portfolio standard deviation is *a positive* function of the standard deviation and weights of the individual assets held in the portfolio. The second part ($2w_1w_2Cov_{1,2}$) shows us that portfolio standard deviation is also dependent on how the two assets move in relation to each other (covariance or correlation). See Example 1-4.

Example 1-4: Mean Return, Variance of Returns, Covariance of Returns, and Correlation

An analyst gathered the following information regarding the returns on two stocks:

Year	Stock 1 Return	Stock 2 Return
2006	0.200	0.100
2007	0.100	0.150
2008	–0.150	–0.050
2009	–0.200	0.100
2010	0.050	0.050
2011	0.100	0.200

Calculate the mean return, sample variance, sample covariance, and correlation of returns for these two stocks.

Solution

Year	Stock 1 Return	Stock 2 Return	$R_t - R_1$	$R_t - R_2$	$(R_t - R_1)(R_t - R2)$
2006	0.200	0.100	0.183	0.008	0.002
2007	0.100	0.150	0.083	0.058	0.005
2008	–0.150	–0.050	–0.167	–0.142	0.024
2009	–0.200	0.100	–0.217	0.008	–0.002
2010	0.050	0.050	0.033	–0.042	–0.001
2011	0.100	0.200	0.083	0.108	0.009
Sum	**0.100**	**0.550**			**0.036**

Stock 1:

The mean return is calculated by dividing the sum of the individual annual returns by the number of years in the sample.

$$\text{Mean Return} = \bar{R}_1 = \frac{\Sigma R_1}{n} = \frac{0.1}{6} = 1.67\%$$

Sample variance is calculated by dividing the sum of the squared deviations from the mean (sum of the contents of Column 4) by the number of years in the sample minus 1.

$$\text{Sample variance} = s^2 = \sum_{n=1}^{N} \left(R_t - \bar{R}_1\right)^2 / (N-1)$$

$$s_1^2 = \frac{\left[(0.183)^2 + (0.083)^2 + (-0.167)^2 + (-0.217)^2 + (0.033)^2 + (0.083)^2\right]}{(6-1)}$$

$$s_1^2 = 0.0247$$

Sample standard deviation is calculated as the square root of sample variance.

$$\text{Sample standard deviation} = s_1 = (0.0247)^{1/2} = 0.1572$$

Stock 2:

$$\text{Mean Return} = \bar{R}_2 = \frac{0.55}{6} = 9.17\%$$

$$\text{Sample variance} = s_2^2 = \frac{[(0.008)^2 + (0.058)^2 + (-0.142)^2 + (0.008)^2 + (-0.042)^2 + (0.108)^2]}{(6-1)}$$

$$s_2^2 = 0.0074$$

$$\text{Sample standard deviation} = s_2 = (0.0074)^{1/2} = 0.0860$$

Sample covariance is calculated by dividing the sum of the products of the deviations from the mean for the stocks (sum of the contents of Column 6) by the number of years in the sample minus 1.

$$\text{Sample covariance} = \text{Cov}_{1,2} = \frac{[\Sigma(R_t - R_1)(R_t - R_2)]}{(n-1)}$$

$$= \frac{0.036}{(6-1)}$$

$$= 0.0072$$

Finally, sample correlation is calculated by dividing the covariance of returns by the product of the standard deviations of returns of the two stocks.

$$\text{Sample correlation} = \frac{\text{Cov}_{1,2}}{s_1 s_2} \frac{0.0072}{(0.1572 \times 0.0860)} = 05326$$

Historical Return and Risk

Historical Mean Return and Expected Return

Historical return refers to the return that was actually earned in the past, while expected return refers to the return that an investor expects to earn in the future. Historical returns are calculated from historical data, while expected returns are determined by the real risk-free interest rate, expected inflation, and expected risk.

Even though investors sometimes use historical returns to forecast expected returns, one must bear in mind that there is no guarantee that returns earned in the past will be earned in the future.

Risk-Return Trade-off

Every investment decision involves a trade-off between risk and return. Empirical evidence has shown that over the long run, market prices reward higher risk with higher returns.

Other Investment Characteristics

In order to evaluate investments using mean (expected return) and variance (risk), we need to make the following assumptions:

- Returns follow a normal distribution (which is fully described by its mean and variance).
- Markets are informationally and operationally efficient.

When these assumptions are violated we need to consider additional investment characteristics.

Distributional Characteristics

We have discussed the characteristics of a normal distribution in Quantitative Methods. The mean-variance framework is only appropriate for evaluating investments whose returns are normally distributed. In reality however, returns are not always normally distributed. Deviations from normality may occur either because of skewness or kurtosis.

- *Skewness* refers to the asymmetry of a returns distribution.
  - When most of the distribution is concentrated on the left, it is referred to as right skewed or positively skewed.
  - When most of the distribution is concentrated to the right, it is referred to as left skewed or negatively skewed.
- *Kurtosis* refers to fat tails or higher than normal probabilities for extreme returns. This leads to an increase in an asset's risk that is not captured by the mean-variance framework.

Market Characteristics

Markets are not always operationally efficient. One limitation on operational efficiency in markets is liquidity. Liquidity has an impact on the bid-ask spread (illiquid stocks have a wider spread) and on the price impact of a trade (illiquid stocks suffer a greater price impact).

Informational efficiency is discussed in later readings on market efficiency.

LESSON 2: RISK AVERSION, PORTFOLIO SELECTION, AND PORTFOLIO RISK

LOS 42d: Explain risk aversion and its implications for portfolio selection.

Vol 4, pp 341–350

The Concept of Risk Aversion

Suppose an investor is offered two alternatives:

Option 1: He is guaranteed $25 in one year.
Option 2: There is a 50% chance that he will get $50 in one year, and a 50% chance that he will get nothing.

The expected value in both these cases is $25, but there are three possibilities regarding the investor's preferences.

1. The investor may play it safe and go with Option 1. This behavior is indicative of **risk aversion**. Risk-averse investors aim to maximize returns for a given level of risk and minimize risk for a given level or return. Historically, there has been a positive relationship between risk and return, which suggests that market prices are primarily determined by investors who are predominantly risk averse.
2. The investor may choose to gamble and go with Option 2. Such **risk-seeking** investors get extra utility or satisfaction from the uncertainty associated with their investments. Even though most individuals do exhibit risk-seeking behavior in isolated situations (e.g., gambling at casinos when the expected value of the payoff can even be negative), risk aversion is the standard assumption in the investment arena.
3. The investor may be indifferent between the two options. Such **risk-neutral** investors seek higher returns irrespective of the level of risk inherent in an investment.

Risk tolerance refers to the level of risk that an investor is willing to accept to achieve her investment goals.

- The lower the risk tolerance, the lower the level of risk acceptable to the investor.
- The lower the risk tolerance, the higher the risk aversion.

Utility Theory and Indifference Curves

In the investment management arena, utility is a measure of the relative satisfaction that an investor derives from a particular portfolio. For example, a risk-averse investor obtains a higher utility from a definite outcome relative to an uncertain outcome with the same expected value. In order to quantify the preferences for investment choices using risk and return, utility functions are used. An example of a utility function is:

$$U = E(R) - \frac{1}{2}A\sigma^2$$

where:
U = Utility of an investment
E(R) = Expected return
σ^2 = Variance of returns
A = Additional return required by the investor to accept an additional unit of risk

"A" is a measure of risk aversion. It is higher for investors who are more risk averse as they require larger compensation for accepting more risk.

The utility function listed on the previous page assumes the following:

- Investors are generally risk averse, but prefer more return to less return.
- Investors are able to rank different portfolios based on their preferences and these preferences are internally consistent. This means that if Investment A is preferred to Investment B, and Investment B is preferred to Investment C, Investment A must be preferred to Investment C.

Utility cannot be compared across individuals because it is a personal concept. Consequently, it cannot be summed among individuals to determine utility from the societal standpoint.

We can draw the following conclusions from the utility function:

- Utility is unbounded on both sides—it can be highly negative or highly positive.
- Higher return results in higher utility.
- Higher risk results in lower utility.
- The higher the value of "A," the higher the negative effect of risk on utility.

Note that utility is not an absolute level of satisfaction. A portfolio with a utility, "U," of 2.5 is not necessarily two times as satisfying as a portfolio with a "U" of 1.25. However, the former would definitely be preferred to the latter.

The risk-free asset, which has a variance (risk) of zero, generates the same utility for all types of investors.

Important Notes Regarding the Risk Aversion Coefficient, "A"

- "A" is positive for a risk-averse investor. Additional risk reduces total utility.
- It is negative for a risk-seeking investor. Additional risk enhances total utility.
- It equals zero for a risk-neutral investor. Additional risk has no impact on total utility.

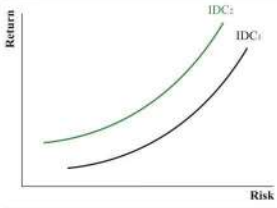
Indifference Curves

The risk-return tradeoff that an investor is willing to bear can be illustrated by an indifference curve. An investor realizes the same total utility or satisfaction from every point on a given indifference curve. Since each investor can have an infinite number of risk-return combinations that generate the same utility, indifference curves are continuous at all points. Two points relating to indifference curves for risk-averse investors are worth noting:

1. They are *upward sloping*. This means that an investor will be indifferent between two investments with different expected returns only if the investment with the lower expected return entails a lower level of risk as well.
2. They are *curved*, and their slope becomes steeper as more risk is taken. The increase in return required for every unit of additional risk increases at an increasing rate because of the diminishing marginal utility of wealth.

Figure 2-1 illustrates two indifference curves. While an investor would be equally happy at any point on IDC_1, she would prefer any point on IDC_2 to any point on IDC_1. This is because IDC_2 offers a higher level of return for every given level of risk compared to IDC_1. The utility of risk-averse investors increases as we move north-west.

Figure 2-1: Indifference Curves and Risk Aversion

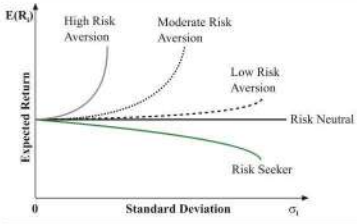


The slope of an indifference curve represents the extra return required by the investor to accept an additional unit of risk. See Figure 2-2.

- A risk-averse investor would have a relatively steep indifference curve (significant extra return required to take on more risk).
- A less risk-averse investor would have a flatter indifference curve (lower extra return required to take on more risk).
- A risk-seeking investor would have an indifference curve with a negative slope. Her utility increases with higher return and higher risk.
- A risk-neutral investor would have a perfectly horizontal indifference curve. Her utility does not vary with risk.

The risk aversion coefficient (in the utility function) and the slope of the indifference curve are positively related.

Figure 2-2: Indifference Curves of Various Types of Investors



For the remainder of the section on portfolio management, we shall assume that all investors are risk-averse. See Example 2-1.

Example 2-1: Computation of Utility

Answer the questions below based on the following information:

Investment	Expected Return; E(r)	Standard Deviation (s)
A	8%	19%
B	10%	24%
C	17%	28%
D	24%	32%

Utility formula:

$$U = E(R) - \frac{1}{2}A\sigma^2$$

1. Which investment will a risk-averse investor with a risk aversion coefficient of 5 choose?
2. Which investment will a risk-averse investor with a risk aversion coefficient of 3 choose?
3. Which investment will a risk-neutral investor choose?
4. Which investment will a risk-loving investor choose?

Solution

The following table shows the utility for risk-averse investors with A = 5 and A = 3.

Investment	Expected Return; E(r)	Standard Deviation (σ)	Utility at A = 5	Utility at A = 3
A	8%	19%	–0.010	0.0259
B	10%	24%	–0.044	0.0136
C	17%	28%	–0.026	0.0524
D	24%	32%	–0.016	0.0864

1. A risk-averse investor with a risk aversion coefficient of 5 would choose Investment A.
2. A risk-averse investor with a risk aversion coefficient of 3 would choose Investment D.
3. A risk-neutral investor's risk aversion coefficient is 0. She wants the highest return possible and therefore, would choose Investment D.
4. A risk-loving investor likes both higher risk and higher return. Therefore, she would choose Investment D as well.

Application of Utility Theory to Portfolio Selection

The Risk-Free Asset

The expected return on a risk-free asset is entirely certain and therefore the standard deviation of its expected returns is zero ($\sigma_{RFR} = 0$). The return earned on the risk-free asset is the risk-free rate (RFR).

The relevant portion of the CFA Program curriculum invests a weight of w_i in the risk-free asset. We assume that w_i equals the weight of the risky asset in the portfolio. The conclusion of the analysis is the same.

Expected Return for a Portfolio Containing a Risky Asset and the Risk-Free Asset

Let's assume that we invest a proportion of our investable funds (w_i) in a risky asset (i) that has an expected return, $E(R_i)$, and variance, σ_i^2, and the remainder ($1 - w_i$) in the risk-free asset that has an expected return of RFR and a variance of zero.

The expected return for the portfolio that includes the risk-free asset and a risky asset is simply the weighted average of their expected returns.

$$E(R_p) = w_i E(R_i) + (1 - w_i)RFR \quad \text{or} \quad E(R_p) = RFR + w_i[E(R_i) - RFR]$$

Equation 1

where:
w_i = Proportion of funds invested in the risky asset.
$E(R_i)$ = The expected rate of return on the risky asset.

Standard Deviation of a Portfolio Containing a Risky Asset and the Risk-Free Asset

Recall that the variance for a two-asset portfolio is given as:

$$\sigma^2_{portfolio} = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2\rho_{1,2}$$

Substituting the risk-free asset for Asset 1, and the risky asset (i) for Asset 2, this formula becomes:

$$\mathbf{S}^2_{portfolio} = (1 - w_i)^2\mathbf{S}^2_{RFR} + w_i^2\sigma_i^2 + 2(1 - w_i)w_i\mathbf{S}_{RFR}\sigma_i\mathbf{R}_{RFR,i}$$

The variance of the risk-free asset is zero because it has a guaranteed return. Further, the return on the risk-free asset does not vary with the return on any risky asset. Therefore, the correlation between the risk-free asset and the risky asset is also zero ($\mathbf{R}_{RFR,i} = 0$). Hence, the expression for the variance of a portfolio becomes:

$$\sigma^2_{port} = w_i^2\sigma_i^2$$

The standard deviation of a portfolio that combines a risk-free asset with a risky asset is a linear proportion of the standard deviation of the risky asset.

$$\sigma_{port} = w_i\sigma_i$$

The expression for the standard deviation of the portfolio can be reorganized to get an expression for w_i:

$$w_i = \frac{\sigma_{port}}{\sigma_i} \longrightarrow \textit{Equation 2}$$

Replacing w_i with $\frac{\sigma_{port}}{\sigma_i}$ in Equation 1, we can state the expected return on the portfolio as a function of portfolio risk:

$$E(R_p) = RFR + w_i[E(R_i) - RFR] \quad \textit{(Equation 1)}$$

$$E(R_p) = RFR + \frac{\sigma_{port}}{\sigma_i}[E(R_i) - RFR]$$

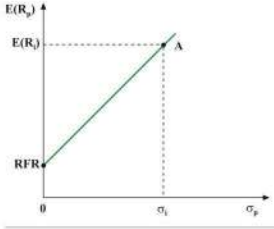
$$E(R_p) = RFR + \sigma_{port}\frac{[E(R_i) - RFR]}{\sigma_i}$$

This equation that relates the return on a portfolio composed of the risk-free asset and a risky asset to the standard deviation of the portfolio is known as the capital allocation line (CAL). The CAL has an intercept of RFR and a constant slope that equals:

$$\frac{[E(R_i) - RFR]}{\sigma_i}$$

The expression for the slope of the CAL is the extra return required for each additional unit of risk and is also known as the market price of risk. See Figure 2-3.

Figure 2-3: Capital Allocation Line with Two Assets



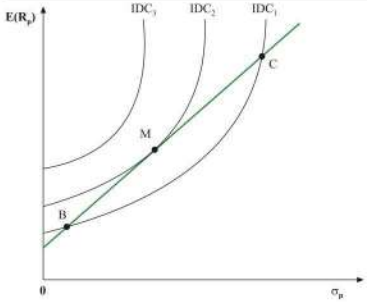
- At Point RFR, the portfolio only consists of the risk-free asset. Therefore, its expected return equals RFR and variance equals zero.
- At Point A, the portfolio only consists of the risky asset. Therefore its expected return equals $E(R_i)$ and variance equals σ_i^2
- Risk-return combinations beyond Point A can be obtained by borrowing at the risk-free rate ($1 - w_i < 0$) and investing in the risky asset ($w_i > 1$).

The next question is which of these numerous portfolios that lie along the CAL will actually be chosen by the investor? The answer lies in combining indifference curves with the CAL. Indifference curves represent the investor's utility function, while the CAL represents the risk-return combinations of the set of portfolios that the investor can invest in. Portfolios that lie below the CAL may be invested in, but then the investor would not be maximizing the potential return given the level of risk she is willing to take. Portfolios that lie above the CAL are desirable, but cannot be attained with the given assets.

From Figure 2-4 notice that:

- IDC_3, which lies above the CAL, is most desirable but cannot be attained with the available assets.
- IDC_1 intersects the CAL at two different points, Point B and Point C. Both these points offer the same level of satisfaction to the investor, as they lie on the same indifference curve.
- IDC_2 is tangential to the CAL at Point M.

Figure 2-4: Portfolio Selection

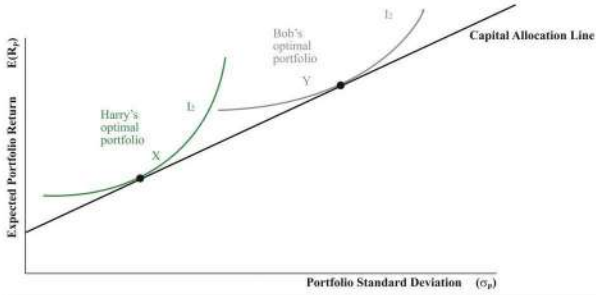


Given a choice between investing in a portfolio on IDC_1 (Points B or C) or in a portfolio on IDC_2 (Point M) an investor would choose the portfolio on IDC_2 as it offers a higher level of satisfaction (it lies to the northwest of IDC_1). Therefore, Point M (the point of tangency between the investor's indifference curve and the CAL) represents the optimal portfolio for this investor.

Portfolio Selection for Two Investors with Different Levels of Risk Aversion

The indifference curve of a relatively more risk-averse investor (Harry) would lie to the left of the indifference curve of a less risk-averse investor (Bob) because he has a lower tolerance for risk. Notice that Harry's optimal portfolio has a lower expected return and a lower level of risk than Bob's optimal portfolio. Further, for the same level of return, Harry's indifference curve has a higher slope, which suggests that he needs a greater incremental return than Bob for taking additional risk. See Figure 2-5.

Figure 2-5: Optimal Portfolios



LOS 42e: Calculate and interpret portfolio standard deviation. Vol 4, pp 350–361

LOS 42f: Describe the effect on a portfolio's risk of investing in assets that are less than perfectly correlated. Vol 4, pp 350–361

Portfolio Risk

Earlier in this reading, we learned that in addition to being a function of individual asset variances and their weights in the portfolio, *portfolio variance also depends on the covariance (and correlation) between the assets in the portfolio*. The formula for the standard deviation of a portfolio of risky assets is:

$$\sigma_p = \sqrt{\sigma_p^2} = \sqrt{\sum_{i=1}^{n} w_i^2\sigma_i^2 + \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j Cov_{i,j}} \qquad i \neq j$$

The formula for the standard deviation of a portfolio consisting of two risky assets is:

$$\sigma_p = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2\rho_{1,2}} \text{ or } \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2Cov_{1,2}}$$

The formula for the standard deviation of a portfolio consisting of three risky assets is:

$$\sigma_p = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + w_3^2\sigma_3^2 + 2w_1w_2Cov_{1,2} + 2w_2w_3Cov_{2,3} + 2w_3w_1Cov_{3,1}}$$

The first part of the formula for the two-asset portfolio standard deviation ($w_1^2\sigma_1^2 + w_2^2\sigma_2^2$) tells us that portfolio standard deviation is *a positive* function of the standard deviation and weights of the individual assets held in the portfolio. The second part ($2w_1w_2Cov_{1,2}$) shows us that portfolio standard deviation is also dependent on how the two assets move in relation to each other (covariance or correlation).

From the two-asset portfolio standard deviation formula it is also important to understand that:

- The maximum value for portfolio standard deviation will be obtained when the correlation coefficient equals +1.
- Portfolio standard deviation will be minimized when the correlation coefficient equals −1.
- If the correlation coefficient equals zero, the second part of the formula will equal zero and portfolio standard deviation will lie somewhere in between.

Implications

- When asset returns are *negatively* correlated, the final term in the standard deviation formula is negative and serves to *reduce* portfolio standard deviation.
- If the correlation between assets equals zero, portfolio standard deviation is *greater* than when correlation is negative.
- When asset returns are positively correlated, the second part of the formula for portfolio standard deviation is also positive and portfolio standard deviation is higher than when the correlation coefficient equals zero. With a correlation coefficient of +1 (perfect positive correlation) there are no diversification benefits.

Let's go through a brief example to highlight some important points. Assets A and B have the following expected returns, portfolio weights, variances, and standard deviations:

Asset	E(R)	Weight	σ^2	σ
A	0.10	0.5	0.0081	0.09
B	0.05	0.5	0.0049	0.07

Portfolio standard deviations in various correlation scenarios are given below.

Scenario	Correlation Between Assets	Portfolio Standard Deviation
a	−1	0.01
b	−0.5	0.0409
c	0	0.057
d	0.5	0.0695
e	1	0.08

First of all, remember that the portfolio's expected return does *not* vary with the correlation coefficient of the two assets. The expected return for this portfolio equals 0.075 or 7.5%.

a. With perfectly negative correlation, the standard deviation of the portfolio is at its lowest (1%). The negative covariance term significantly offsets the individual asset variance terms.
b. With a correlation of −0.5 the standard deviation of the portfolio is not at its lowest, but is still relatively low (4.09%) due to the negative covariance term.
c. With zero correlation, portfolio standard deviation (5.7%) is higher than it is with negative correlation, but lower than it is with positive correlation.
d. With a correlation of 0.5 the standard deviation of the portfolio is still higher (6.95%).

e. With perfect positive correlation, the standard deviation of the portfolio (8%) is at its highest possible level. There are no diversification benefits from investing in the portfolio when correlation is +1. In this scenario, portfolio standard deviation is simply the weighted average of the standard deviations of the individual assets. This is because the expression for portfolio standard deviation is in the form of:

Recall from high school algebra that an expression in the form of $(a + b)^2$ can be expanded to $(a^2 + b^2 + 2ab)$

$$\sigma_{port} = \sqrt{(w_A\sigma_A)^2 + (w_B\sigma_B)^2 + 2(w_A\sigma_A)(w_B\sigma_B)(1)}$$

which can be simplified to:

$$\sigma_{port} = \sqrt{[(w_A\sigma_A) + (w_B\sigma_B)]^2} \Rightarrow \sigma_{port} = (w_A\sigma_A) + (w_B\sigma_B)$$

Conclusion: The risk (standard deviation) of a portfolio of risky assets depends on the asset weights and standard deviations, *and most importantly on the correlation of asset returns*. The *higher* the correlation between the individual assets, the *higher* the portfolio's standard deviation.

Constant Correlation with Changing Weights

Using the same two assets, now let's change the weights of the individual assets in the portfolio, and use a constant correlation coefficient of zero to gauge the impact on portfolio standard deviation.

Portfolio	w_A	w_B	$E(R_{port})$	σ_{port}
f	0	1	0.05	0.07
g	0.25	0.75	0.0625	0.0571
h	0.5	0.5	0.075	0.57
i	0.75	0.25	0.0875	0.0697
j	1	0	0.1	0.09

From Figure 2-6, notice the following:

- The set of risk-return combinations for the 5 portfolios traces an ellipse that starts at Portfolio f (Asset B's risk-return profile), and goes through the 50–50 point onto Portfolio j (Asset A's risk-return profile).
- With assets that have a correlation of less than +1, it is possible to form portfolios that have a *lower* risk than either of the individual assets. This holds true for Portfolios g, h, and i in our example.
- A conservative investor can experience both a higher return and a lower risk by diversifying into a higher-risk, higher-return asset if the correlation between the assets is fairly low. Suppose a conservative investor is fully invested in Asset B (Portfolio f), where she expects a return of 5% with a portfolio standard deviation of 7%. By shifting 25% of her assets into the higher-risk asset (Asset A) and investing in Portfolio g, she can increase her expected return to 6.25% and lower the standard deviation of her portfolio to 5.71%.

Figure 2-6: Risk Return Tradeoff

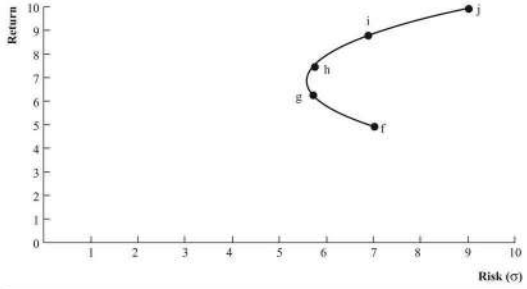
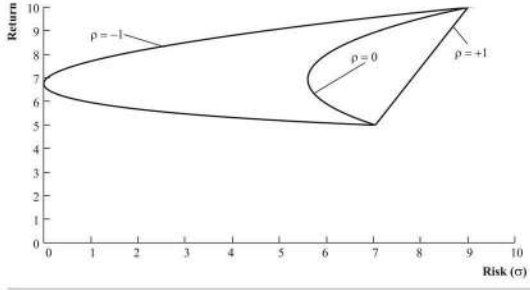


Figure 2-7 shows the change in curvature of the risk-return relationship between assets depending on their weights, as a function of the correlation between the two assets.

Figure 2-7: Effect of Correlation on Portfolio Risk and Return



Notice that for any mix of asset weights, the maximum value that the portfolio standard deviation can take is equal to the higher of the individual assets' standard deviations.

Notice the following from Figure 2-7:

- When correlation equals +1, the risk-return combinations that result from altering the weights lie along a straight line between the two assets' risk-return profiles.
- As correlation falls, the curvature of this line increases.
- When correlation equals −1, the curve is represented by two straight lines that meet at the vertical axis. This point represents a zero-risk portfolio where portfolio return must equal the risk-free rate to prevent arbitrage.

Portfolios of Many Risky Assets

As more and more assets are added to a portfolio, the contribution of each individual asset's risk to portfolio risk diminishes. The covariance among the assets in the portfolio accounts for the bulk of portfolio risk.

Further, given that there are a large number of assets in the portfolio, if we assume that all assets in the portfolio have the same variance and the same correlation among assets, the portfolio can have a variance of zero (zero risk) if the individual assets are unrelated to one another.

Avenues for Diversification

Investors can diversify by:

- Investing in a variety of asset classes (e.g., large cap stocks, small cap stocks, bonds, commodities, real estate, etc.) that are not highly correlated.
- Using index funds that minimize the costs of diversification and grant exposure to specific asset classes.
- Investing among countries that focus on different industries, are undergoing different stages of the business cycle, and have different currencies.
- Choosing not to invest a significant portion of their wealth in employee stock plans, as their human capital is already entirely invested in their employing companies.
- Only adding a security to the portfolio if its Sharpe ratio is greater than the Sharpe ratio of the portfolio times the correlation coefficient.
- Only adding a security to the portfolio if the benefit (additional expected return, reduced portfolio risk) is greater than the associated costs (trading costs and costs of tracking a larger portfolio).
- Adding insurance to the portfolio by purchasing put options or adding an asset class that has a negative correlation with the assets in the portfolio (e.g., commodities).

LESSON 3: EFFICIENT FRONTIER AND INVESTOR'S OPTIMAL PORTFOLIO

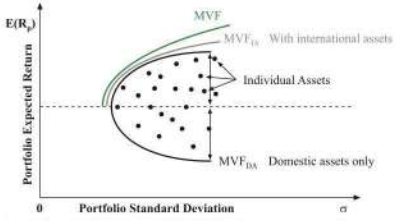
LOS 42g: Describe and interpret the minimum-variance and efficient frontiers of risky assets and the global minimum-variance portfolio.

Vol 4, pp 362–374

We have learned that combining risky assets may result in a portfolio that has lower risk than any of the individual assets in the portfolio (the third bullet on the previous page). As the number of assets available increases, they can be combined into a large number of different portfolios (each with different assets and weights), and we can create an opportunity set of investments.

Combinations of these assets can be formed into portfolios that entail the lowest level of risk for each level of expected return. An envelope curve that plots the risk-return characteristics of the lowest risk "domestic assets only" portfolios is labeled MVF_{DA} (minimum-variance frontier—domestic assets) on Figure 3-1. As international assets are added to the portfolio, portfolio risk for each level of return can be reduced further given that international assets are not perfectly positively correlated with domestic assets. Therefore, the minimum-variance frontier that includes international assets (MVF_{IA}) lies to the left of MVF_{DA}. Similarly, once all possible investments and asset classes are considered, the minimum-variance frontier (MVF) that plots the risk-return characteristics of portfolios that minimize portfolio risk at each given level of return lies further to the left. We will work with this minimum-variance frontier as we move forward and assume that all assets and asset classes have been considered in deriving this minimum-variance frontier. Note that no risk-averse investor would invest in any portfolio that lies to the right of the MVF, as it would entail a higher level of risk than a portfolio that lies on the MVF for a given level of return.

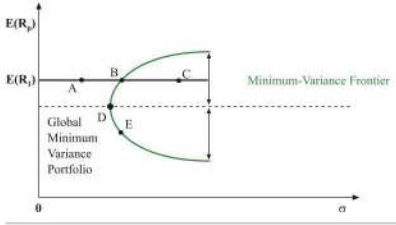
Figure 3-1: Investment Opportunity Set



In Figure 3-2, notice that Portfolios A, B, and C all have the same expected return, $E(R_1)$. Portfolio A entails the lowest level of risk, but lies to the left of the minimum variance frontier so it cannot be attained given the investment opportunity set. The minimum risk that the investor can take to earn $E(R_1)$ is by investing in Portfolio B. A risk-averse investor would invest in Portfolio B over Portfolio C as it entails lower risk for the same expected return. Portfolio D defines the global minimum-variance portfolio. It is the portfolio of risky securities that entails the lowest level of risk among all the risky asset portfolios on the minimum-variance frontier.

Note the emphasis on "risky" assets. Later, the introduction of the risk-free asset will allow us to relax this constraint.

Figure 3-2: Minimum-Variance Frontier



The minimum-variance frontier represents portfolios with the lowest level of risk for each level of expected return. Investors aim to maximize expected return for each level of risk. Given a choice between Portfolios B and E (that entail the same level of risk and lie on the minimum-variance frontier), an investor would prefer Portfolio B as it offers a higher return. Therefore, all portfolios on the MVF that lie above and to the right of the global minimum-variance portfolio dominate all portfolios on the MVF that lie below and to the right of the global minimum-variance portfolio.

This dominant portion of the MVF (the one above and to the right of the global minimum-variance portfolio) is known as the Markowitz efficient frontier. It contains all the possible portfolios that rational, risk-averse investors will consider investing in.

An important thing to note about the efficient frontier is that the slope of the curve decreases as we move to the right. The additional return attained as investors take on more risk (by successively moving to the right along the Markowitz efficient frontier to portfolios with more and more risk) declines.

A Risk-Free Asset and Many Risky Assets

Now let's bring the risk-free asset into our analysis. The risk-free asset has zero risk (so it plots on the y-axis), an expected return of RFR, and zero correlation with risky assets. Further, the risk-return characteristics of portfolios that combine the risk-free asset with a risky asset or a portfolio of risky assets lie along a straight line.

An investor can attain any point along CAL_A by investing a certain portion of her funds in the risk-free asset and the remainder in a portfolio of risky assets (Portfolio A). The set of portfolios that lies on CAL_A (combinations of the risk-free asset and Portfolio A with varying weights) dominates all the risky-asset portfolios on the efficient frontier below Point A because portfolios along CAL_A have a higher return than the portfolios on the efficient frontier with the same risk (standard deviation).

The difference between the CALs that we are using here and the CAL described earlier in the reading is that back then we were combining the risk-free asset with a risky asset. Now that we are working with the Markowitz efficient frontier, we are combining the risk-free asset with different portfolios of risky assets.

Likewise, any position can be attained along CAL_B by investing in some combination of the risk-free asset and Portfolio B of risky assets. Again, these potential combinations of the risk-free asset and Portfolio B dominate all portfolio possibilities on the efficient frontier below Point B. Further, any portfolio that lies on CAL_B dominates any portfolio on CAL_A because portfolios that lie on CAL_B offer a higher expected return for any given level of risk compared to those on CAL_A.

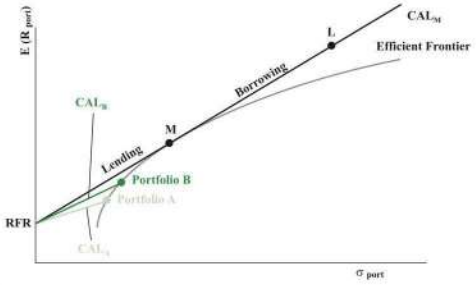
Therefore, as the investor combines the risk-free asset with portfolios further up the efficient frontier, she keeps attaining better portfolio combinations. Each successive portfolio on the efficient frontier has a steeper line (higher slope) joining it to the risk-free asset. The slope of this line represents the additional return per unit of extra risk. The steeper the slope of the line, the better risk-return tradeoff the portfolio offers. The line with the steepest slope is the one that is drawn from the risk-free asset to Portfolio M (which occurs at the point of tangency between the efficient frontier and a straight line drawn from the risk-free rate). This particular line offers the best risk-return tradeoff to the investor. Any combination of the risk-free asset and Portfolio M dominates all portfolios below $\mathbf{CAL_M}$.

It is essential to understand what we have accomplished here. By adding the risk-free asset, we have narrowed down the risky asset portfolio that an investor would invest in to a single optimal portfolio, Portfolio M, which is at the point of tangency between $\mathbf{CAL_M}$ and the efficient frontier.

- At Point RFR, an investor has all her funds invested in the risk-free asset.
- At Point M she has all of her funds invested in Portfolio M (which is entirely composed of risky securities).
- At any point between RFR and M, she holds both Portfolio M and the risk-free asset (i.e., she is lending some of her funds at the risk-free rate).

However, an investor may want to attain a higher expected return than available at Point M, where all her funds are invested in the risky-asset portfolio. Adding leverage to the portfolio by borrowing money at the RFR and investing it in the risky asset portfolio will allow her to attain risk-return profiles beyond (to the right of, or above) Point M on the $\mathbf{CAL_M}$ (e.g., Point L). See Figure 3-3.

Figure 3-3: Optimal Risky Portfolio



The Two-Fund Separation Theorem

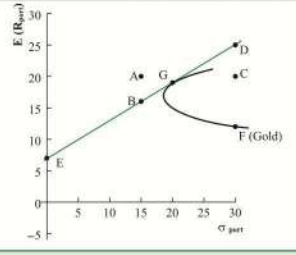
The two-fund separation theorem states that regardless of risk and return preferences, all investors hold some combination of the risk-free asset and an optimal portfolio of risky assets. Therefore, the investment problem can be broken down into two steps:

1. The investing decision, where an investor identifies her optimal risky portfolio.
2. The financing decision, where she determines where exactly on the optimal CAL, she wants her portfolio to lie. Her risk preferences (as delineated by her indifference curves) determine whether her desired portfolio requires borrowing or lending at the risk-free rate.

Example 3-1: Choosing the Right Portfolio

Based on the information in Figure 3-4 and the table that follows, answer the following questions:

Figure 3-4: Choosing the Right Portfolio



Point	Return (%)	Risk (%)
A	20	15
B	16	15
C	20	30
D	25	30
E	7	0
F (Gold)	12	30
G	19	20

1. Which of the above points is not achievable?
2. Which of the portfolios will not be chosen by a rational, risk-averse investor?
3. Which of these portfolios is most suitable for a risk-neutral investor?
4. Why is gold held by many rational investors as part of a larger portfolio, when it is shown in the graph to lie on the inefficient part of the feasible set?

Solution

1. Portfolio A lies outside the feasible set and therefore is not achievable.
2. Portfolios C and F will not be chosen by a rational, risk-averse investor. This is because Portfolio D provides higher return (25%) than both of them for the same level of risk (30%). Portfolios C and F are the only investable points that do not lie on the capital allocation line.
3. Portfolio D is most suitable for a risk-neutral investor who does not care about risk and wants the highest possible return.
4. Although gold lies on the inefficient part of the feasible set, it is still held by many rational investors as part of a larger portfolio. This is because gold has low or negative correlation with many risky assets, which helps to reduce the overall risk of the portfolio.

LOS 42h: Explain the selection of an optimal portfolio, given an investor's utility (or risk aversion) and the capital allocation line.

Vol 4, pp 393–396

Optimal Investor Portfolio

The line CAL_M in Figures 3-3 and 3-5 represents the best portfolios available to an investor. The portfolios along this line contain the risk-free asset and the optimal portfolio, Portfolio M, with varying weights. An individual's optimal portfolio depends on her risk-return preferences, which are incorporated into her indifference curves.

Figure 3-5: Optimal Investor Portfolio

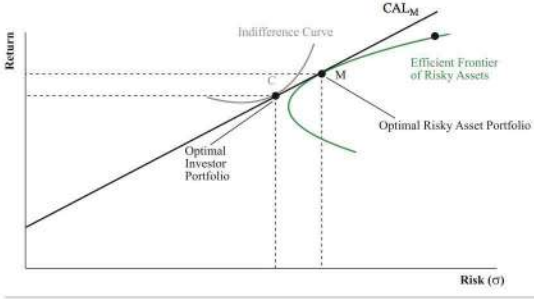


Figure 3-5 shows an investor's indifference curve, which is tangent to the CAL_M at Point C. Therefore, the optimal investor portfolio for this particular investor is Portfolio C on the CAL_M.

For a more risk-averse investor, the optimal investor portfolio would lie closer to the y-axis (a higher proportion invested in the risk-free asset), while a less risk-averse investor's

optimal portfolio would lie closer to Portfolio M, and further away from the y-axis. An investor with an even higher tolerance for risk might borrow money at the risk-free rate to invest in Portfolio M. Her optimal portfolio would lie to the right of Portfolio M on CAL_M.

The thing to notice is that we have been able to account for all types of investors' risk preferences by using just two items—the risk-free asset and Portfolio M that consists of risky assets. Portfolio M is the optimal risky asset portfolio and will be selected by a rational, risk-averse investor regardless of her preferences. The only decision that the investor makes is how to divide her funds between the risk-free asset and the Portfolio M.

READING 43: PORTFOLIO RISK AND RETURN: PART II

LESSON 1: CAPITAL MARKET THEORY

Before getting into the LOS for this reading, we summarize some of the important takeaways from the previous sections on portfolio management:

- Risky assets can be combined into portfolios that may have a lower risk than each of the individual assets in the portfolio if assets are not perfectly positively correlated.
- An investor's investment opportunity set includes all the individual risky assets and risky asset portfolios that she can invest in.
- The minimum-variance frontier reduces the investment opportunity set to a curve that contains only those portfolios that entail the lowest level of risk for each level of expected return.
- The global minimum-variance portfolio is the portfolio of risky assets that entails the lowest level of risk among all portfolios on the minimum-variance frontier.
- Investors aim to maximize return for every level of risk. Therefore, all portfolios above and to the right of the global minimum-variance portfolio dominate those that lie below and to the right of the global minimum-variance portfolio.
- The section of the minimum-variance frontier that lies above and to the right of the global minimum-variance portfolio is referred to as the Markowitz efficient frontier.

LOS 43a: Describe the implications of combining a risk-free asset with a portfolio of risky assets. Vol 4, pp 388–394

A risk-free asset has an expected return of the risk-free rate (RFR), a standard deviation (risk) of zero, and a correlation with any risky asset of zero. Once the risk-free asset is introduced into the mix:

- Any portfolio that combines a risky asset portfolio that lies on the Markowitz efficient frontier and the risk-free asset has a risk-return tradeoff that is linear (CAL is represented by a straight line).
- The point at which a line drawn from the risk-free rate is tangent to the Markowitz efficient frontier defines the optimal risky asset portfolio. This line is known as the optimal CAL.
- Each investor will choose a portfolio (optimal investor portfolio) that contains some combination of the risk-free asset and the optimal risky portfolio. The weights of the risk free asset and the optimal risky portfolio in the optimal investor portfolio depend on the investor's risk tolerance (indifference curve).
- The optimal investor portfolio is defined by the point where the investor's indifference curve is tangent to the optimal CAL.

LOS 43b: Explain the capital allocation line (CAL) and the capital market line (CML). Vol 4, pp 392–400

Going forward, we shall assume that all investors have homogenous expectations. Given that all investors in the market have identical expectations regarding the risk-return distribution for each asset, only one optimal risky portfolio exists. If investors have different expectations regarding various assets, there would be different optimal risky portfolios.

If markets are **informationally efficient** (i.e., market price is an unbiased estimate of the sum of the discounted values of a security's expected cash flows), investors would not be able to earn a rate of return that exceeds the required rate of return from the investment. In this case, investors should adopt passive investment strategies as they entail lower costs and are easy to administer.

If however, an investor has more confidence in her abilities to forecast cash flows and estimate growth rates and discount rates, she might consider an active investment strategy. She would use her forecasts to determine whether an asset is fairly priced by the market and trade on any perceived mispricing.

When we refer to the "market" we are referring to all assets (e.g., stocks, bonds, real estate, commodities, etc.) that are tradable and investable. For our purposes, going forward, we will define the term "market" quite narrowly as the S&P500 Index. The terms "market return" and "market risk premium" therefore refer to the return on the S&P500 and the U.S. equity risk premium (difference between the S&P500 return and the U.S. long-term interest rate) respectively.

The Capital Market Line

A capital allocation line (CAL) includes all combinations of the risk-free asset and **any risky asset portfolio**. The capital market line (CML) is a special case of the capital allocation line where the risky asset portfolio that is combined with the risk-free asset is the **market portfolio**.

Graphically, the market portfolio occurs at the point where a line from the risk-free asset is tangent to the Markowitz efficient frontier. The market portfolio is the optimal risky asset portfolio given homogenous expectations. All portfolios that lie below the CML offer a lower return than portfolios that plot on the CML for each level of risk.

An interesting point is that the slopes of the CML and CAL are constant even though they represent combinations of two assets. The important thing to note is that they are not combinations of two risky assets, but of a risk-free asset and a risky portfolio.

The risk and return characteristics of portfolios that lie on the CML can be computed using the risk and return formulas for two-asset portfolios.

Expected return on portfolios that lie on CML

$$E(R_p) = w_f R_f + (1 - w_f) E(R_m)$$

Variance of portfolios that lie on CML

$$\sigma^2 = w_f^2 \sigma_f^2 + (1 - w_f)^2 \sigma_m^2 + 2 w_f (1 - w_f) \text{Cov}(R_f, R_m)$$

The derivation of this expression relating the expected return of portfolios that lie on the CML to their variance (risk) is very similar to the derivation of the CAL equation in Reading 42. The only difference is that the risky asset, i, in the CAL is replaced by the market portfolio, m, in the CML.

Equation of CML

$$E(R_p) = R_f + \frac{E(R_m) - R_f}{\sigma_m} \times \sigma_p$$

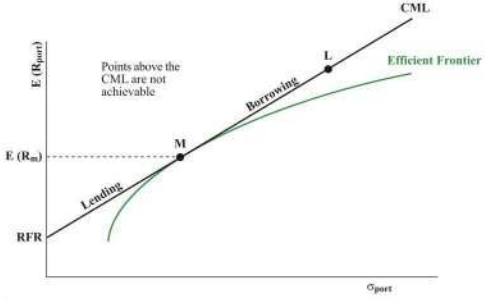
where:

y-intercept = R_f = risk-free rate

$$\text{slope} = \frac{E(R_m) - R_f}{\sigma_m} = \text{market price of risk}$$

Figure 1-1 illustrates the CML.

Figure 1-1: Capital Market Line



- At Point RFR, an investor has all her funds invested in the risk-free asset.
- At Point M she has all of her funds invested in the market portfolio (which only contains risky securities).
- At any point between RFR and M, she holds both the market portfolio and the risk-free asset (i.e., she is lending some of her funds at the risk-free rate).

However, an investor may want to attain a higher expected return than available at Point M, where all her funds are invested in the market portfolio. Adding leverage to the portfolio by borrowing money at the RFR and investing it in the market portfolio will allow her to attain a risk-return profile beyond (to the right of, or above) Point M on the CML (e.g., Point L).

The particular point that an investor chooses on the CML depends on her utility function, which in turn is determined by her risk and return preferences. See Example 1-1.

Example 1-1: Risk and Return of a Leveraged Portfolio

Sasha Miles is evaluating how to allocate funds between the risk-free asset and the market portfolio. She gathers the following information:

- Risk-free rate of return = 6%
- Expected return on the market portfolio = 14%
- Standard deviation of returns of the market portfolio = 23%

Calculate the expected risk and return of a portfolio that is:

a. 75% invested in the market portfolio.
b. 140% invested in the market portfolio.

Recall that the standard deviation of the risk-free asset, and the covariance of returns between the risk-free asset and the market portfolio, both equal 0.

A weight of 140% in the market portfolio implies that the investor borrows 40% of the funds at the risk-free rate (6%).

Solution

Portfolio return and standard deviation can be calculated using the following equations:

$$E(R_p) = w_1 R_f + (1 - w_1) E(R_m)$$

$$\sigma_p = (1 - w_1)\sigma_m$$

a. $E(R_p) = w_1 R_f + (1 - w_1) E(R_m)$

$E(R_p) = (0.25 \times 0.06) + (0.75 \times 0.14) = 12\%$

$\sigma_p = (1 - w_1)\sigma_m$

$\sigma_p = (0.75 \times 0.23) = 17.25\%$

b. $E(R_p) = (-0.4 \times 0.06) + (1.4 \times 0.14) = 17.2\%$

$\sigma_p = (1.4 \times 0.23) = 32.2\%$

Leveraged Positions with Different Lending and Borrowing Rates

In the previous section, we assumed that an investor could borrow or lend unlimited amounts of funds at the risk-free rate. Practically speaking, an investor's ability to repay is not as certain as that of the U.S. government, so the rate at which she would be able to borrow would be higher than the rate at which she would be able to lend. Given the disparity in borrowing and lending rates, the CML would no longer be a straight line (see Figure 1-2).

The slope of the CML to the left of Point M (when she invests a portion of her portfolio in the risk-free asset at R_f) would be:

$$\frac{E(R_m) - R_f}{\sigma_m}$$

While the slope CML to the right of Point M (where she is borrowing at R_b) would be:

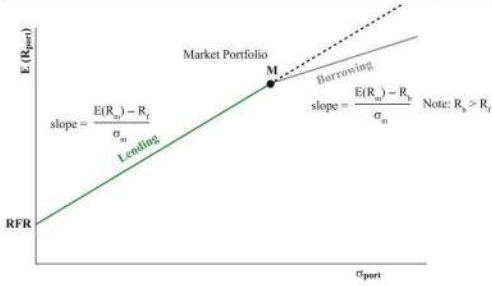
$$\frac{E(R_m) - R_b}{\sigma_m}$$

All passively managed portfolios would lie on the kinked CML even though an investor's investment in the risk free asset may be:

- Positive (the investor's optimal portfolio would lie between RFR and Point M)
- Zero (the investor's optimal portfolio would lie at Point M)
- Negative (the investor's optimal portfolio would lie to the right of Point M)

The risk and return for a leveraged portfolio is higher than that of an unleveraged portfolio. Further, given that the investor's borrowing rate is higher than the risk-free rate, for each additional unit of risk taken beyond Point M (when the portfolio is leveraged), the investor gets a lower increase in expected return compared with portfolios to the left of Point M (where the portfolio is not leveraged).

Figure 1-2: CML with Different Lending and Borrowing Rates



LESSON 2: PRICING OF RISK AND COMPUTATION OF EXPECTED RETURN

LOS 43c: Explain systematic and nonsystematic risk, including why an investor should not expect to receive additional return for bearing nonsystematic risk. Vol 4, pp 400–402

Systematic and Nonsystematic Risk

When investors diversify across assets that are not perfectly positively correlated, the portfolio's risk is lower than the weighted average of the individual assets' risks. In the market portfolio, all the risk unique to individual assets comprising the portfolio has been diversified away. The risk that disappears due to diversification in the portfolio construction process is known as **unsystematic risk** (also known as unique, diversifiable, or firm-specific risk). The risk inherent in all risky assets (caused by macro-economic variables) that cannot be eliminated by diversification is known as **systematic risk** (also known as nondiversifiable or market risk).

Total Risk = Systematic risk + Unsystematic risk

Complete diversification of a portfolio requires the elimination of all unsystematic or diversifiable risk. Once unsystematic risk has been eliminated and only systematic risk remains, a completely diversified portfolio would correlate perfectly with the market.

By adding assets to a portfolio that are not perfectly correlated with the assets already in the portfolio, we can reduce the overall standard deviation of the portfolio. However, we cannot eliminate the variability and uncertainty of macroeconomic factors that affect returns on all risky assets. We do not have to include all the assets in the market portfolio to diversify away unsystematic risk. Studies have shown that a portfolio consisting of 12 to 30 different stocks can diversify away 90% of unsystematic risk. Whatever the exact number of different stocks required to eliminate unsystematic risk, it is significantly lower than *all* the risky assets comprising the market portfolio. Further, we can attain a lower level of systematic risk by diversifying globally versus only diversifying within one country, because some of the domestic systematic risk factors (such as monetary policy) are not perfectly correlated with systematic risk variables in other countries.

In capital market theory, taking on a higher degree of unsystematic risk will not be compensated with a higher return because unsystematic risk can be eliminated, without additional cost, through diversification. Only if an investor takes on a higher level of risk that cannot be easily diversified away (systematic risk) should she expect to be rewarded in the form of a higher return. Systematic risk is measured as the contribution of a security to the risk of a well diversified portfolio.

This conclusion has very important implications for asset pricing and expected returns. If risk is measured in terms of the standard deviation of returns of a stock, the riskiest stock will not necessarily have the highest expected return. For example, consider a tech firm whose entire business is reliant on the success of one particular technology. If the innovation is a success, the returns on the company's stock would be phenomenal, but if its product does not penetrate the market, the company would go out of business. The two scenarios facing this company are extreme. It is a stock with a high standard deviation of expected returns and high total risk.

Compare an investment in this tech company to an investment in a large manufacturing company that has a relatively well-known brand. This company may not seem to be a very risky investment in terms of total risk (standard deviation of expected returns), but it is relatively more sensitive to changes in the macroeconomic environment than the tech company.

Most of the risk inherent in the tech company's stock is firm specific in nature. Market factors like the rate of economic growth make up a relatively small proportion of the total risk of this company. The major chunk of its total risk (measured by standard deviation) can be diversified away by adding other stocks to the portfolio. For the manufacturing company, most of its standard deviation in expected returns (total risk) arises from macroeconomic risk factors that cannot be diversified away.

Even though the tech stock has a higher level of total risk, capital market theory dictates that the market will expect a higher return on the investment that has a higher level of systematic risk, regardless of total risk. Unsystematic risk is not rewarded by an efficient market because it can be diversified away at no cost. *Therefore, the expected return on an individual security only depends on its systematic risk.*

As we have seen earlier, portfolios on the CML offer a better risk-return tradeoff than portfolios that plot below it, so it effectively becomes the new efficient frontier for investors. The CML leads all investors to invest in the same risky asset portfolio, Portfolio M. Investors only differ regarding their exact position on the CML, which depends on their risk preferences.

LOS 43d: Explain return generating models (including the market model) and their uses. Vol 4, pp 402–405

Return-Generating Models

A return-generating model is a model that is used to forecast the return on a security given certain parameters. A multi-factor model uses more than one variable to estimate returns.

- Macroeconomic factor models use economic factors (e.g., economic growth rates, interest rates, and inflation rates) that correlate with security returns to estimate returns.
- Fundamental factor models use relationships between security returns and underlying fundamentals (e.g., earnings, earnings growth, and cash flow growth) to estimate returns.

- Statistical factor models use historical and cross-sectional returns data to identify factors that explain returns and use an asset's sensitivity to those factors to project future returns.

A general return generating model may be expressed as:

$$E(R_i) - R_f = \sum_{j=1}^{k} \beta_{ij} E(F_j) = \beta_{i1}[E(R_m) - R_f] + \sum_{j=2}^{k} \beta_{ij} E(F_j)$$

where:
$E(F_1), E(F_2), \ldots E(F_k)$ = Various factors in the model. There are k number of factors in the model
B_{ij} = Factor weights, or loads associated with each factor.
$E(R_i) - R_f$ = Excess return
$E(R_m)$ = Market return

The Market Model

The market model is an example of a single-index return generation model. It is used to estimate beta risk and to compute abnormal returns. The market model is given as:

$$R_i = \alpha_i + \beta_i R_m + e_i$$

First, the intercept α_i and slope coefficient β_i are estimated using historical asset and market returns. These estimates are then used to predict returns in the future. See Example 2-1.

Example 2-1: Using the Market Model to Calculate Abnormal Returns

A regression of ABC Stock's historical monthly returns against the return on the S&P500 gives an α_i of 0.002 and a β_i of 1.05. Given that ABC Stock rises by 3% during a month in which the market rose 1.25%, calculate the abnormal return on ABC Stock.

Solution

ABC Stock's expected return for the month = 0.002 + 1.05 × 0.0125 = 0.015125 or 1.51%

ABC's company-specific return (abnormal return) = 0.03 – (0.015125) = 0.014875 or 1.49%

LOS 43e: Calculate and interpret beta. Vol 4, pp 405–409

Calculation and Interpretation of Beta

Beta is a measure of the sensitivity of an asset's return to the market's return. It is computed as the covariance of the return on the asset and the return on the market divided by the variance of the market. See Example 2-2.

$$\beta_i = \frac{Cov(R_i, R_m)}{\sigma_m^2} = \frac{\rho_{i,m}\sigma_i\sigma_m}{\sigma_m^2} = \frac{\rho_{i,m}\sigma_i}{\sigma_m}$$

Example 2-2: Calculating Asset Beta

Given that the standard deviation of the returns on the market is 18%, calculate beta for the following assets:

- Asset A, which has a standard deviation twice that of the market and zero correlation with the market.
- Asset B, which has a standard deviation of 24% and its correlation of returns with the market equals –0.2.
- Asset C, which has a standard deviation of 20% and its covariance of returns with the market is 0.035.

Solution

We use the following formula for calculating beta:

$$\beta_i = \frac{\rho_{i,m}\sigma_i}{\sigma_m}$$

Since the correlation of Asset A with the market equals zero, its beta also equals zero.

Asset B's beta = $(-0.2 \times 0.24) / 0.18 = -0.267$

Asset C's beta = $0.035 / 0.18^2 = 1.08$

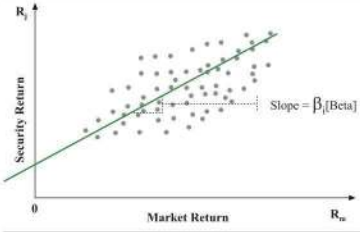
Important Points Regarding Beta

- Beta captures an asset's systematic or nondiversifiable risk.
- A positive beta suggests that the return on the asset follows the overall trend in the market.
- A negative beta indicates that the return on the asset generally follows a trend that is opposite to that of the current market trend.
- A beta of zero means that the return on the asset is uncorrelated with market movements.
- The market has a beta of 1. Therefore, the average beta of stocks in the market also equals 1.

Estimating Beta Using Regression Analysis

The market model described previously can also be used to compute beta. Historical market and asset returns are used to determine α_i and β_i (see Figure 2-1.). The length of the period from which the inputs to the regression model are drawn from is extremely important. If data over a short time period are used, beta estimates may be affected by special events during that period. If data over a longer time period are used, they can be a poor gauge of future performance if major changes have occurred in the asset.

Figure 2-1: Beta Estimation with a Plot of Security and Market Returns



LESSON 3: THE CAPITAL ASSET PRICING MODEL

LOS 43f: Explain the capital asset pricing model (CAPM), including its assumptions, and the security market line (SML). **Vol 4, pp 409–414**

LOS 43g: Calculate and interpret the expected return of an asset using the CAPM. **Vol 4, pg 416**

The Capital Asset Pricing Model

The capital asset pricing model (CAPM) is a single-index model that is widely used to estimate returns given security betas. The CAPM is expressed as:

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

Assumptions of the CAPM

- Investors are utility-maximizing, risk-averse, rational individuals.
- Markets are frictionless and there are no transaction costs and taxes.
- All investors have the same single-period investment horizon.
- Investors have homogenous expectations and therefore arrive at the same valuation for any given asset.
- All investments are infinitely divisible.
- Investors are price-takers. No investor is large enough to influence security prices.

The Security Market Line

The SML illustrates the CAPM equation. Its y-intercept equals the risk-free rate and its slope equals the market risk premium, $(R_m - R_f)$.

Efficient portfolios are those that offer the highest return for each level of risk.

Recall that the CAL and the CML are only applied to efficient portfolios, not to individual assets or inefficient portfolios. They used total risk on the x-axis, and since only systematic risk is priced, they could only be used for efficient portfolios (those with no unsystematic risk and whose total risk therefore was the same as their systematic risk).

The SML and the CAPM on the other hand, apply to any security or portfolio, regardless of whether it is efficient. This is because they are based only on a security's systematic risk, not total risk.

The CAPM equation tells us that the expected (required) rate of return for a risky asset is determined by the risk-free rate plus a risk premium. The risk premium for an asset is determined by the systematic risk of the asset, (β_i), and the prevailing market risk premium, $(R_m - R_f)$. See Example 3-1.

Example 3-1: Using the SML to Compute Expected Returns

Assume that the risk-free rate in an economy is 5% and the return on the market portfolio is expected to be 10%. Compute the expected rates of return for the following 5 securities:

Stock	Beta
A	0.75
B	1.00
C	1.15
D	1.5
E	−0.25

Solution

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

$$E(R_A) = R_f + \beta_A[E(R_m) - R_f] = 0.05 + 0.75(0.10 - 0.05) = 8.75\%$$

$$E(R_B) = R_f + \beta_B[E(R_m) - R_f] = 0.05 + 1.00(0.10 - 0.05) = 10\%$$

$$E(R_C) = R_f + \beta_C[E(R_m) - R_f] = 0.05 + 1.15(0.10 - 0.05) = 10.75\%$$

$$E(R_D) = R_f + \beta_D[E(R_m) - R_f] = 0.05 + 1.5(0.10 - 0.05) = 12.5\%$$

$$E(R_E) = R_f + \beta_E[E(R_m) - R_f] = 0.05 + (-0.25)(0.10 - 0.05) = 3.75\%$$

- Security C and D's betas are greater than market beta (1). These securities have a higher level of systematic risk than the market, meaning that they are more risky than the market portfolio. The expected return on these assets is therefore greater than the return on the market.
- Security A and E's betas are lower than market beta. These securities have a lower level of systematic risk than the market, meaning that they are less volatile than the market portfolio. Therefore the expected return on these assets is lower than the return on the market.

- A security with a negative beta (Stock E) is quite rare in practice. Notice that its required or expected return is even lower than the risk-free rate. This is because its negative beta *reduces* systematic portfolio risk.
- Stock B's beta equals market beta, so its expected return equals the rate of return expected from the market (10%).

Portfolio Beta

The CAPM can also be applied to portfolios of assets.

- The beta of a portfolio equals the weighted average of the betas of the securities in the portfolio.
- The portfolio's expected return can be computed using the CAPM (see Example 3-2):

$$E(R_p) = R_f + \beta_p[E(R_m) - R_f]$$

Example 3-2: Portfolio Beta and Return

Allison invests 25% of her money in the risk-free asset, 35% in the market portfolio, and 40% in Alpha Corp, a U.S. stock that has a beta of 1.5. Given that the risk-free rate and the expected return on the market are 5% and 14% respectively, calculate the portfolio's beta and expected return.

Solution

The beta of the risk-free asset and that of the market equal 0 and 1 respectively. The beta of the portfolio is calculated as:

$$\beta_{Portfolio} = w_1\beta_1 + w_2\beta_2 + w_3\beta_3$$

$$\beta_{Portfolio} = (0.25 \times 0) + (0.35 \times 1) + (0.4 \times 1.5) = 0.95$$

Expected return of the portfolio = $R_f + \beta(R_m - R_f)$

Expected return of the portfolio = 5% + 0.95 (14% − 5%) = 13.55%

LOS 43h: Describe and demonstrate applications of the CAPM and the SML. Vol 4, pp 414–425

Applications of the CAPM

Estimate of expected return: The expected rate of return computed from the CAPM is used by investors to value stocks, bonds, real estate, and other assets. In capital budgeting, where the NPV is used to make investing decisions, the CAPM is used to compute the required rate of return, which is then used to discount expected future cash flows. See Example 3-3.

Example 3-3: Application of the CAPM to Capital Budgeting

The directors of Mercury Inc. are considering investing in a new project. The project requires an initial investment of $550 million in one year. The probability of success is 60%. If it is successful, the project will provide an income of $350 million at the end of Year 2, but will also require a further investment of $200 million. Further, it will generate net income of $250 million in each of Years 3 and 4. At the end of Year 4, the company will sell the project for $300 million. If the project is unsuccessful, the company will not earn anything. Given that the market return is 14%, risk-free rate is 4%, and beta of the project is 1.5, answer the following questions:

1. Calculate the annual cash flows using the probability of success.
2. Calculate the expected return.
3. Calculate the net present value.

Solution

1. Year 1 = −$550m
   Year 2 = 0.6 × ($350m − $200m) = $90m
   Year 3 = 0.6 × $250m = $150m
   Year 4 = 0.6 × ($250m + $300m) = $330m

2. Using the CAPM, the expected or required rate of return is calculated as:

   Required return = 4% + [1.5 × (14% − 4%)] = 19%

3. Use the following TI calculator keystrokes to calculate NPV.

   [CF] [2ND] [CE|C]
   [↓] 550 [+/−] [ENTER] [↓][↓]
   90 [ENTER] [↓][↓]
   150 [ENTER] [↓][↓]
   330 [ENTER] [NPV]
   19 [ENTER] [↓] [CPT]

   NPV = −$145.06 million

Portfolio Performance Evaluation

The *Sharpe ratio* is used to compute excess returns per unit of total risk. It is calculated as:

$$\text{Sharpe ratio} = \frac{R_p - R_f}{\sigma_p}$$

Notice that the Sharpe ratio basically equals the slope of the CAL. A portfolio with a higher Sharpe ratio is preferred to one with a lower Sharpe ratio given that the numerator of the portfolios being compared is positive. If the numerator is negative, the ratio will be closer to zero (less negative) for riskier portfolios, resulting in distorted rankings. Two drawbacks of the Sharpe ratio are that it uses total risk as a measure of risk even though only systematic risk is priced, and that the ratio itself is not informative.

The *Treynor ratio* basically replaces total risk in the Sharpe ratio with systematic risk (beta). It is calculated as:

$$\text{Treynor ratio} = \frac{R_p - R_f}{\beta_p}$$

For the Treynor ratio to offer meaningful results, both the numerator and the denominator must be positive. Neither the Sharpe nor the Treynor ratio offer any information about the significance of the differences between the ratios for portfolios.

M-squared (M^2) is also based on total risk, not beta risk. It is calculated as:

$$M^2 = (R_p - R_f)\frac{\sigma_m}{\sigma_p} - (R_m - R_f)$$

M^2 offers rankings that are identical to those provided by the Sharpe ratio. However, these rankings are easier to interpret as they are in percentage terms. A portfolio that matches the market's performance will have an M^2 of zero, while one that outperforms the market will have a positive M^2. The M^2 also enables us to tell which portfolios beat the market on a risk-adjusted basis.

Jensen's alpha is based on systematic risk (like the Treynor ratio). It first estimates a portfolio's beta risk using the market model, and then uses the CAPM to determine the required return from the investment (given its beta risk). The difference between the portfolio's actual return and the required return (as predicted by the CAPM) is called Jensen's alpha. Jensen's alpha is calculated as:

Jensen's alpha is the maximum that an investor should be willing to pay the portfolio manager.

$$\alpha_p = R_p - [R_f + \beta_p(R_m - R_f)]$$

Jensen's alpha for the market equals zero. The higher the Jensen's alpha for a portfolio, the better its risk-adjusted performance (see Example 3-4).

Example 3-4: Portfolio Performance Evaluation

The following table provides information about the portfolio performance of three investment managers:

Manager	Return	σ	β
A	13%	20%	0.6
B	11%	15%	1.1
C	12%	10%	0.8
Market (M)	10%	16%	
Risk-free rate (R_f)	4%		

1. Calculate the following for each of the investment managers:
   a. Expected return
   b. Sharpe ratio
   c. Treynor ratio
   d. M^2
   e. Jensen's alpha
2. Comment on your answers and rank the managers' performance.

Solution

1. We illustrate the calculations for Manager A. The table that follows summarizes the results for all managers.

   Manager A

   $$\text{Expected return} = R_f + \beta(R_m - R_f) = 4\% + [0.6 \times (10\% - 4\%)] = 7.6\%$$

   $$\text{Sharpe ratio} = \frac{R_A - R_f}{\sigma_A} = \frac{13\% - 4\%}{20\%} = 0.45$$

   $$\text{Treynor ratio} = \frac{R_A - R_f}{\beta_A} = \frac{13\% - 4\%}{0.6} = 0.15$$

   $$M^2 = (R_A - R_f)\frac{\sigma_m}{\sigma_A} - (R_A - R_f) = (13\% - 4\%)\frac{16\%}{20\%} - (10\% - 4\%) = 1.2\%$$

   $$\text{Jensen's alpha} = R_A - [R_f + \beta(R_m - R_f)] = 13\% - [4\% + 0.6(10\% - 4\%)] = 5.4\%$$

Manager	Expected Return	Sharpe Ratio	Treynor Ratio	M^2	Jensen's Alpha
A	7.6%	0.45	0.150	1.20%	5.4%
B	10.6%	0.47	0.064	1.47%	0.4%
C	8.8%	0.8	0.1	6.80%	3.2%
Market	10%	0.375	0.060	0	0
R_f	4%	–	–	–	0

Ranking of portfolios by performance

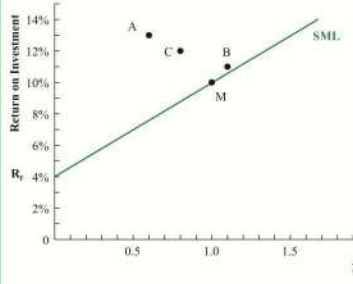
Rank	Sharpe Ratio	Treynor Ratio	M^2	Jensen's Alpha
1	C	A	C	A
2	B	C	B	C
3	A	B	A	B
4	M	M	M	M
5	–	–	–	R_f

2. When considering total risk (relevant when the portfolio is not fully diversified), we look at the Sharpe ratio and M^2. C performs the best as she has both the highest Sharpe ratio (0.8) and the highest M^2 (6.8).

   When we consider systematic risk (relevant when the portfolio is well diversified), we look at the Treynor ratio and Jensen's alpha. Manager A performs the best as she has both the highest Treynor ratio (0.15) and the highest Jensen's alpha (5.4%).

   Notice that all three managers outperform the benchmark as the risk-return profiles of their performance lie above the SML, as shown in Figure 3-1:

Figure 3-1: Portfolio Performance Versus SML



We can see from the graph that A performs the best on a risk-adjusted basis as it lies northwest relative of the other portfolios.

All these measures assume that an appropriate portfolio is used as the benchmark portfolio.

A question arises as to when analysts should use measures like the Sharpe ratio and M^2 (that are based on total risk) and when they should use the Treynor ratio or Jensen's alpha (that are based on beta risk). Total risk is relevant when an investor holds an inefficient portfolio (one that is not fully diversified)

Security Characteristic Line

The security characteristic line (SCL) plots the excess returns of a security against the excess returns on the market. The equation of the SCL is given as:

$$R_i - R_f = \alpha_i + \beta_i (R_m - R_f)$$

Note that Jensen's alpha is the y-intercept, and beta is the slope of the SCL.

Security Selection: Identifying Mispriced Securities

Table 3-1 uses the same five stocks that we used in Example 2-1. We now calculate the expected return on these five securities based on their expected dividends, expected prices in one year, and current market prices.

Table 3-1: Calculation of Expected Return

Stock	Beta	Required Return from SML	Current Price (P0)	Expected Dividend (D1)	Expected Price (P1)	Expected Return [(P1 + D1)/P0] – 1
A	0.75	8.75%	25	1	26.31	[(26.31+1)/25] –1 = **9.24%**
B	1.00	10%	32	0.75	34.45	[(34.45+0.75)/32] –1 = **10%**
C	1.15	10.75%	15	0.80	15.7	[(15.70+0.80)/15] –1 = **10%**
D	1.5	12.5%	7	Nil	7.95	[(7.95+0)/7] –1 = **13.57%**
E	–0.25	3.75%	48	1.5	48.3	[(48.30+1.50)/48] –1 = **3.75%**

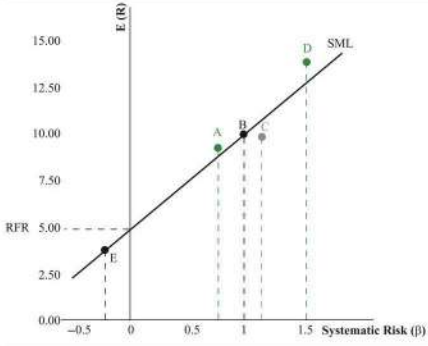
To determine whether a security is undervalued or overvalued, we compare the return that the security offers (based on its expected future price and dividend payments over the holding period) to the return it should offer to compensate investors for its systematic risk (beta). For example, based on our forecasts, Stock A offers a return of 9.24%. Based on the CAPM, the return required form Stock A to compensate for its beta risk is 8.75%. Stock A's current price is too low, which is why its expected return is higher than the required return (according to the CAPM). Therefore, Stock A is *undervalued* and investors should buy it.

Our forecasted return for Stock C (10%) is lower than the return required by investors for investing in a stock with a beta of 1.15 (10.75%). Stock C's current price is too high. Therefore, investors should *sell* the stock based on the given forecasts.

- If the expected return using price and dividend forecasts is *higher* than the investor's required return given the systematic risk in the security, the security is *undervalued* and the investor should *buy* it.
- If the expected return using price and dividend forecasts is *lower* than the investor's required return given the systematic risk in the security, the security is *overvalued* and the investor should *sell* it.

Let's plot the forecasted returns on these securities on the same graph as the SML (which illustrates the required return from securities with various levels of systematic risk). See Figure 3-2.

Figure 3-2: Mispriced Securities



- Notice from Figure 3-2 that Stock A and D plot *above* the SML. This is because the expected return on these stocks is *greater* than their required return. Securities that plot *above* the SML are *undervalued* and should be *purchased*.
- Stock B and E plot on the SML. This means that the expected return on these securities equals the return required from these securities. These stocks are *fairly valued*.
- Stock C plots below the SML. The expected return for this stock falls short of the return required to compensate investors for the systematic risk inherent in the security. This stock is *overvalued* and should be *sold*.

Constructing a Portfolio

The CAPM tells us that investors should hold a portfolio that combines the risk-free asset with the market portfolio. Let's assume that we begin with the S&P 500 as our risky asset portfolio. The S&P 500 index only contains large-cap U.S. stocks, but does not encompass the entire global market. Therefore, we might want to consider a security not included in the S&P 500 for inclusion in the portfolio. The decision regarding whether the particular security should be included in our portfolio depends on the α_i of the security (based on the CAPM and the S&P 500 as the market portfolio). Positive α_i securities (even if they are correctly priced) should be added to the portfolio.

Further, within the set of securities included in the S&P 500, some may be undervalued (expected to generate positive alpha) and others may be overvalued (expected to generate negative alpha) based on investor expectations. The weight of undervalued securities should be increased and that of overvalued securities should be reduced. See Example 3-5.

The information ratio $\left(\frac{\alpha_i}{\sigma_{ei}}\right)$ measures the abnormal return per unit of risk added by the security to a well-diversified portfolio. The larger the information ratio is, the more valuable the security.

The weight of each nonmarket security in the portfolio should be proportional to:

$$\frac{\alpha_i}{\sigma_{ei}^2}$$

where:
α_i = Jensen's alpha
σ_{ei}^2 = Nonsystematic variance of the security

Example 3-5: Optimal Investor Portfolio with Heterogeneous Beliefs

An investor gathers the following information regarding three stocks, which are not in the market portfolio:

Stocks	Expected Return	Standard Deviation	Beta
A	16%	29%	1.7
B	20%	24%	1.4
C	18%	21%	1.2

Given that the return on the market portfolio is 13% with a standard deviation of 15%, and the risk-free rate of return is 5%, answer the following questions:

1. Calculate Jensen's alpha for Stocks A, B, and C.
2. Calculate nonsystematic variance for A, B, and C.
3. If an investor holds the market portfolio, should she add any of these three stocks to her portfolio? If so, which stock should have the highest weight in the portfolio?

Solution

1. $\alpha_A = R_A - [R_f + \beta(R_m - R_f)] = 13\% - [4\% + 0.6(10\% - 4\%)] = 5.4\%$

   $\alpha_A = 16\% - [5\% + 1.7(13\% - 5\%)] = -0.026$

   $\alpha_B = 20\% - [5\% + 1.4(13\% - 5\%)] = 0.038$

   $\alpha_C = 18\% - [5\% + 1.2(13\% - 5\%)] = 0.034$

2. Nonsystematic variance = Total variance – Systematic variance

   $\sigma_{ei}^2 = \sigma_i^2 - \beta_i^2 \sigma_m^2$

   A's nonsystematic variance $= (0.29)^2 - (1.7^2 \times 0.15^2) = 0.0191$

   B's nonsystematic variance $(0.24)^2 - (1.4^2 \times 0.15^2) = 0.0135$

   C's nonsystematic variance $(0.21)^2 - (1.2^2 \times 0.15^2) = 0.0117$

3. Stock A should not be included in the portfolio as it has a negative alpha. It should only be included if the investor can short the stock.

   On the other hand, Stocks B and C have positive alphas and should be included in the portfolio. Their weights are determined as follows:

   Weight of Stock B = 0.038 / 0.0135 = 2.815

   Weight of Stock C = 0.034 / 0.0117 = 2.906

   In relative terms, the weight of Stock C will be greater than that of Stock B by 3.23% (2.906 / 2.815 – 1).

Beyond the CAPM

Limitations of the CAPM

Theoretical limitations

- The CAPM is a single-factor model; only systematic risk is priced in the CAPM
- It is only a single period model.

Practical limitations

- A true market portfolio is unobservable as it would also include assets that are not investable (e.g., human capital)
- In the absence of a true market portfolio, the proxy for the market portfolio used varies across analysts, which leads to different return estimates for the same asset (not permissible in the CAPM world).

Extensions of the CAPM

Theoretical models like the arbitrage pricing theory (APT) expand the number of risk factors.
Practical models use extensive research to uncover risk factors that explain returns.

READING 44: BASICS OF PORTFOLIO PLANNING AND CONSTRUCTION

LESSON 1: PORTFOLIO PLANNING

LOS 44a: Describe the reasons for a written investment policy statement (IPS). Vol 4, pp 440–441

In order to construct a portfolio that satisfies the client's investment objectives, investment managers first need to devise a plan. This plan is documented in an investment policy statement (IPS).

The Investment Policy Statement

An investment policy statement is an invaluable planning tool that adds discipline to the investment process. Before developing an IPS, an investment manager must conduct a fact finding discussion with the client to learn about the client's risk tolerance and other specific circumstances.

The IPS can be thought of as a roadmap that serves the following purposes:

- It helps the investor decide on realistic investment goals after learning about financial markets and associated risks.
- It creates a standard according to which the portfolio manager's performance can be judged.
- It guides the actions of portfolio managers, who should refer to it from time to time to assess the suitability of particular investments for their clients.

A typical investment policy statement specifies investment objectives and constraints, and the types of risks that the investor is willing to take in order to meet those goals.

Investment goals are expressed in terms of both risk and return. This is because every investment decision involves a trade-off between risk and return. An investor's willingness and ability to take more risk in pursuit of higher returns depends on her individual situation and preferences. However, a manager must ensure that a client's return objectives and risk tolerance are consistent with each other. A client should not expect to earn a relatively high return without taking a relatively high level of risk.

Investment constraints are factors that the investment manager needs to consider when making investments for the client's portfolio. These typically include the following:

- Liquidity requirements.
- Time horizon.
- Tax concerns.
- Regulatory requirements.
- Unique needs and circumstances.

The investment policy statement should be reviewed on a regular basis and updated when there are major economic changes or changes in the client's needs and circumstances.

LOS 44b: Describe the major components of an IPS. Vol 4, pg 441

An investment policy statement does not have a single standard format. It generally includes the following sections:

- An introduction that describes the client.
- A statement of purpose.
- A statement of duties and responsibilities, which describes the duties and responsibilities of the client, the custodian of the client's assets, and the investment manager.
- Procedures that outline the steps required to keep the IPS updated and steps required to respond to various contingencies.
- The client's investment objectives.
- The client's investment constraints.
- Investment guidelines regarding how the policy should be executed (e.g., whether use of leverage and derivatives is permitted) and specific types of assets that must be excluded.
- Evaluation and review guidelines on obtaining feedback on investment results.
- Appendices that describe the strategic asset allocation and the rebalancing policy.

The sections that are most closely linked to a client's distinctive needs, and probably the most important from a planning perspective, are those dealing with investment objectives and constraints.

LOS 44c: Describe risk and return objectives and how they may be developed for a client. Vol 4, pp 442–448

Risk Objectives

It is very important for the portfolio manager to ensure that the risk of the portfolio is suitable for the client. Quantitative risk objectives may be absolute, relative, or a combination of both.

- An example of an absolute risk objective would be that the client does not want to lose more than 5% of her capital over a particular period. A more practical way of stating the same objective would be as a probability statement (e.g., the portfolio should not lose more than 5% of its value over a 12-month period with 95% probability). Measures of absolute risk include the variance, standard deviation, and value at risk.
- Relative risk objectives relate risk to a certain benchmark that represents an appropriate level of risk. For example, investments in large-cap U.K. equities could be benchmarked to the FTSE 100. Tracking risk or tracking error is the appropriate measure of risk relative to a benchmark.

Note that this objective is not related to investment market performance, good or bad, and is absolute in the sense of being self-standing.

Risk objectives for institutional clients may be stated in terms of minimizing the probability of failing to meet their liabilities when they are due.

Risk tolerance is a function of both a client's ability to take risk and her willingness to take risk. The ability to take risk is a function of several factors including time horizon, expected income, and net worth. Generally speaking, a client with a longer time horizon, high expected income, and greater net worth has a greater ability to bear risk. A client's willingness to bear risk, on the other hand, is based on more subjective factors including her psychological makeup and level of understanding of financial markets.

LOS 44d: Distinguish between the willingness and the ability (capacity) to take risk in analyzing an investor's financial risk tolerance. Vol 4, pp 453–456

- When the client's ability to take risk is below average and her willingness to take risk is also below average, the investor's overall risk tolerance is below average.
- When the client's ability to take risk is above average and her willingness to take risk is also above average, the investor's overall risk tolerance is above average.
- When the client's ability to take risk is below average and her willingness to take risk is above average, the investor's overall risk tolerance is below average.
- When the client's ability to take risk is above average and her willingness to take risk is below average, the investment manager should explain the conflict and implications to the client.

When there is a mismatch between a client's ability and willingness to take risk, the prudent approach is to conclude that the client's tolerance for risk is the lower of the two factors. Further, any decisions made must be documented.

Return Objectives

Return objectives may also be stated in absolute or relative terms.

- Absolute return objectives state the percentage return desired by the client. The return may be expressed on a real or nominal basis.
- Relative return objectives express the required return relative to a stated benchmark. A good benchmark should be investable (i.e., an investor should be able to replicate it).

The return objective may be stated before or after fees and on a pre-or post-tax basis. Further, it could also be expressed in terms of a required return (i.e., the amount an investor needs to earn over the investment horizon to meet a specified future goal).

The portfolio manager must ensure that the client's return objective is realistic in light of her tolerance for risk.

LOS 44e: Describe the investment constraints of liquidity, time horizon, tax concerns, legal and regulatory factors, and unique circumstances and their implications for the choice of portfolio assets. Vol 4, pp 448–453

Liquidity

This refers to the ability to readily convert investments into cash at a price close to fair market value. Investors may require ready cash to meet unexpected needs and could be forced to sell their assets at unfavorable terms if the investment plan does not consider their liquidity needs. Therefore, an IPS should state any likely requirements to withdraw funds from the portfolio.

Time Horizon

This refers to the time period between putting funds into an investment and requiring them for use. A close relationship exists between an investor's time horizon, liquidity needs, and ability to take risk. The shorter the time horizon, the harder it would be for an investor to overcome losses. Therefore, low-risk investments are more appropriate for investors with short time horizons.

Tax Concerns

Taxes play a very important role in investment planning because, unlike tax-exempt investors, taxable investors are really only concerned with after-tax returns on their portfolios. The tax code in most countries is very complex. For example, dividend income, interest income, and rental income may be taxed at the investor's marginal tax rate, while capital gains might be taxed at a different rate. Further, capital gains are only taxable after the asset has been sold (the capital gain realized), but unrealized capital gains are not taxable (the tax liability can be deferred indefinitely).

Legal and Regulatory Factors

Investors also need to be aware of legal and regulatory factors. For example, some countries impose a limit on the proportion of equity securities in a pension fund's portfolio. Further, an individual working for a company may be constrained from selling her shares for a period of time if she has access to material nonpublic information about the company (e.g., members of a company's board of directors are prohibited from trading the company's stock before financial results are released).

Unique Circumstances

There may be a number of individual and unusual considerations that affect investors. For example, many investors may want to exclude certain investments from their portfolios based on personal or socially conscious reasons. Because each investor is unique, the implications of this constraint differ for each investor. For example, an investor may not want to invest additional funds in the company she works for if she already has stock options in the company.

LESSON 2: PORTFOLIO CONSTRUCTION

LOS 44f: Explain the specification of asset classes in relation to asset allocation. **Vol 4, pp 456–465**

LOS 44g: Describe the principles of portfolio construction and the role of asset allocation in relation to the IPS. **Vol 4, pp 456–470**

An asset class is a category of assets that have similar characteristics, attributes, and risk-return relationships.

Portfolio Construction

Once the IPS has been compiled, the investment manager begins constructing the portfolio. How the portfolio funds are allocated across different asset classes is referred to as the portfolio's strategic asset allocation (SAA). A portfolio's SAA is important because it is a portfolio's allocation across various asset classes (not its allocation across securities within those asset classes) that is the primary determinant of portfolio returns.

Capital Market Expectations

Capital market expectations refer to a portfolio manager's expectations regarding the risk and return prospects of various asset classes. Capital market expectations are quantified in terms of expected returns, standard deviation of returns, and correlations among asset classes. Return expectations can be developed from historical data, economic analysis, or valuation models, while standard deviation and correlation estimates are primarily obtained from historical data.

The Strategic Asset Allocation

The strategic asset allocation defines how the investor's funds are divided across different asset classes. Traditionally, cash, equities, bonds, and real estate were defined as the major asset classes. Recently, hedge funds, private equity, and commodities have been added to the list. Further each asset class can be subdivided into several sub-classes. For example, bonds can be divided into government and corporate debt. Further, government bonds can be subdivided into domestic and foreign government bonds, while corporate bonds can be divided into investment-grade and high-yield bonds.

When defining asset classes, the following must be considered:

- Each asset class should contain assets that carry a similar expected return and risk and correlations among the assets within a class should be relatively high.
- Each asset class should provide diversification benefits. The correlation of an asset class with other asset classes should be relatively low.
- Asset classes should be mutually exclusive and should cover all investment alternatives.

Sometimes asset classes will be subdivided into smaller classes which are relatively highly correlated with each other. For example, the European and U.S. equity markets have a relatively high correlation, but they may still be treated as separate asset classes for the purposes of portfolio construction because different managers/products may be used to manage investments in U.S. equities and European equities.

The risk-return characteristics of the strategic asset allocation depend on the expected returns and risk of the individual asset classes, and on the correlations between the asset classes. Typically, risk-averse investors will place a higher weight on government bonds and cash in their SAA's, while those with a higher risk tolerance will have a higher weight invested in equities.

A theoretical framework for developing the SAA for a client is by developing the client's utility function and using capital market expectations to determine the risk-return profiles of all investable portfolios available to the client. The utility function can be used to draw up indifference curves, while capital market expectations can be used to determine the efficient frontier. The point of tangency between the two represents the optimal asset allocation for the investor. A change in capital market expectations would cause a movement in the efficient frontier, while a change in the investor's objectives or constraints would result in a shift in her indifference curves. A change in either of both the efficient frontier and the investor's indifference curves would require the strategic asset allocation to be adjusted.

Note that the framework described above may not be followed exactly in practice due to the following reasons:

- An IPS does not explicitly express the client's investment objectives and constraints in terms of a utility function. It usually only provides threshold levels of risk and return along with a description of constraints.
- The constraints listed in the IPS make it more appropriate to use multi-period models. This framework is a single period model.

Steps Toward an Actual Portfolio

1. Risk budgeting: This is the process of subdividing the desired level of portfolio risk (which has been determined in the IPS) across the different sources of investment returns (i.e., the strategic asset allocation, tactical asset allocation, and security selection).
2. Tactical asset allocation: This refers to an allocation where the manager deliberately deviates from the strategic asset allocation for the short term. For example, if a manager believes that equities are in for a difficult few months, she might invest more (than stated in the SAA) of the portfolio in bonds on a temporary basis to enhance portfolio return.
3. Security selection: A manager may be able to outperform the asset class benchmark by investing in particular securities within the asset class that she expects to do well (better than the benchmark).
4. Portfolio rebalancing: Changes in security prices will lead to changes in the weights of different asset classes in the portfolio and cause them to deviate or "drift" from policy weights. Therefore, the portfolio should be rebalanced periodically and brought in line with policy weights. The set of rules that lay out guidelines for rebalancing the portfolio is known as the rebalancing policy and is an important element of risk management.

Deviating from the prescribed weights and aiming to select securities that will outperform the benchmark leads to additional risk over and above the risk in the policy portfolio.

Additional Portfolio Organizing Principles

The top-down investment framework described in this reading has two drawbacks:

- If several managers are hired to manage different subclasses within the same asset class, it may result in underutilization of the risk budget.
- Each manager would trade within the portfolio under her management so the portfolio overall may not be efficient from a capital gains tax point of view.

In order to avoid this, managers invest most of their funds in passive investments and trade a minority of assets actively. This approach is known as the "core-satellite" approach.

Study Session 13: Equity: Market Organization, Market Indices, and Market Efficiency

READING 45: MARKET ORGANIZATION AND STRUCTURE

LESSON 1: THE FUNCTIONS OF THE FINANCIAL SYSTEM, ASSETS, CONTRACTS, FINANCIAL INTERMEDIARIES AND POSITIONS

LOS 45a: Explain the main functions of the financial system. Vol 5, pp 6–14

A financial system consists of markets and financial intermediaries that facilitate the transfer of financial assets, real assets, and financial risks in various forms from one entity to another. There are three main functions of a financial system.

1. To help people achieve their purposes in using the financial system.
2. To facilitate the discovery of the rate of return where aggregate savings equal aggregate borrowings.
3. Allocating capital to its most efficient uses.

1. Helping people achieve their purposes in using the financial system

- The financial system helps in the saving process by creating investment vehicles (e.g., bank deposits, notes, stocks, etc.) that investors can buy or sell in the market without incurring heavy transaction costs.
- The financial system facilitates borrowing by aggregating funds from savers. A well-functioning financial system reduces transaction costs (e.g., the costs of arranging, monitoring, and recovering loans) and makes the borrowing process more efficient.
- Institutions in the financial system help companies in raising equity capital. Further, they value the securities that companies sell and ensure that financial information is accurate and properly disclosed. Transparency and liquidity in markets encourage investor participation.
- The financial system helps to manage various risks (e.g., default risk, exchange rate risk, interest rate risk, and other risks) by offering contracts to hedge those risks. Further, investment banks and exchanges ensure that these instruments trade in liquid markets.
- The financial system facilitates the exchange of assets by creating liquidity in spot markets (markets where assets are traded for immediate delivery). Liquidity reduces transaction costs for traders.
- The financial system facilitates information-based trading by creating liquid markets with low transaction costs. Further, accounting standards and regulatory requirements reduce the cost of information for investors.

2. Determining rates of return

Savers try to move money from the present to the future, while borrowers try to move money from the future to the present. The higher the expected return on saving, the more savers will forgo current consumption and move money to the future. On the other hand, the higher the cost of borrowing, the lower the amount of money borrowers would want to move from the future to the present. The rate at which the aggregate demand for funds (borrowing) equals the aggregate supply of funds (saving) is called the equilibrium interest rate, and determining this rate is one of the most important functions of the financial system.

The required rates of return for securities vary by their risk characteristics, terms, and liquidity.

3. Allocating capital efficiently

Allocative efficiency is reached when the scarce capital in an economy is allocated to the most productive uses. A financial system seeks to ensure that only the best projects obtain the funds available from savers. Investors are wary of making losses so they try to carefully study the prospects of various investments available to them in order to make well-informed decisions regarding where to invest.

LOS 45b: Describe classifications of assets and markets. Vol 5, pp 14–16

Different classifications of assets are described in the next LOS.

Assets may be classified as financial or physical assets:

- Financial assets include securities, currencies, and contracts.
- Physical assets include commodities and real assets.

Markets may be classified on the basis of:

- The timing of delivery.
  - Markets for immediate delivery are referred to as spot markets.
  - Markets where delivery occurs at some point in the future include forward, futures, and options markets.
- Who the seller is.
  - Markets in which securities are sold by issuers (where funds flow from the purchaser to the issuer) are known as primary markets.
  - Markets in which securities are sold by investors (where funds flow between traders) are called secondary markets.
- The maturity of instruments that are traded.
  - Markets that trade debt instruments maturing in one year or less are referred to as money markets.
  - Markets that trade instruments of longer maturities are referred to as capital markets.
- The types of securities:
  - Publicly traded debt, equities, and shares in pooled investment vehicles that hold these securities are referred to as traditional investment markets.
  - Hedge funds, private equity, commodities, real estate securities and properties, and securitized debt are part of alternative investment markets.

LOS 45c: Describe the major types of securities, currencies, contracts, commodities, and real assets that trade in organized markets, including their distinguishing characteristics and major subtypes. Vol 5, pp 16–28

Securities

Securities include bonds, notes, commercial paper, mortgages, common stock, preferred stock, warrants, mutual fund shares, unit trusts, and depository receipts. They may be classified as:

- **Public securities** that trade in public markets (e.g., exchanges). Issuers of public securities are usually required to comply with strict rules and regulatory standards.

- **Private securities** that can typically only be purchased by qualified investors. Private securities are relatively illiquid.

Fixed Income Securities

Fixed income instruments are promises to repay borrowed money. Payments (which include interest and principal amounts) may be pre-specified or may vary according to a fixed formula based on a reference rate. Fixed income instruments may be classified as:

- *Notes*: Fixed income securities with maturities of 10 years or less.
- *Bonds*: Fixed income securities with maturities greater than 10 years.
- *Bills*: These are issued by governments and have maturities of one year or less.
- *Certificates of deposit:* These are issued by banks and usually mature within a year.
- *Commercial paper*: These are issued by corporations and usually mature within a year.
- *Repurchase agreements*: These are short-term lending instruments.
- *Money market instruments*: These are traded in the money market and have maturities of one year or less.

Equities

Equity owners have ownership rights in a company. Equity securities include:

- *Common shares:* Holders of common shares can participate in the company's decision-making process. They are entitled to receive dividends declared by the company, and if the company goes bankrupt they have a claim on the company's assets after all other claims have been satisfied.
- *Preferred shares:* Preferred shareholders have a higher priority in claims on dividends and on the company's assets in case of liquidation. They are entitled to receive fixed dividends on a regular basis.
- *Warrants:* Holders of warrants have the right to purchase an entity's common stock at a pre-specified price at or before the warrants' expiration date.

Pooled Investments

Pooled investment vehicles (e.g., mutual funds, depositories, and hedge funds) issue securities that represent shared ownership in the assets held by them. People invest in these vehicles to benefit from their investment management expertise and to diversify their portfolios.

- *Asset-backed securities:* Companies often use pools of loans or receivables (e.g., auto loans and leases, consumer loans, credit cards, etc.) as underlying assets to issue securities known as asset-backed securities. These securities then transfer any interest and principal payments from the underlying assets to their holders on a monthly basis.

Currencies

These are monies issued by national monetary authorities and primarily trade in the foreign currency market. Retail currency trades occur through ATM machines, credit cards, and debit cards when transactions are executed in currencies different from the currency held in customers' accounts.

Contracts

Contracts are agreements between two or more parties to do something in the future. A contract's value depends on the value of its underlying, which may be a commodity, a security, an index, an interest rate, or even another contract.

Contracts may be settled in cash or may require physical delivery, and may be classified on the basis of:

- The nature of the underlying asset:
  - If the underlying asset is a physical asset, the contract is referred to as a physical contract.
  - If the underlying asset is a financial asset, the contract is referred to as a financial contract.
- The timing of delivery:
  - If the contract requires immediate delivery (i.e., in three days or less), it is referred to as a spot contract and trades in the spot market.
  - If the contract requires delivery to be made in the future (i.e., after three days or more), it may be a forward, futures, swap, or an options contract.

Forward Contracts

A forward is a contract between two parties, where one (the long position) has the obligation to buy, and the other (the short position) has an obligation to sell an underlying asset at a fixed price (established at the inception of the contract) at a future date. Market participants usually enter a forward contract to hedge a pre-existing risk.

Futures Contracts

Futures contracts are similar to forward contracts in that they may also be deliverable or cash-settled, but there are also significant differences between the two. Unlike forward contracts:

- Futures contracts are standardized and trade on organized exchanges.
- A clearinghouse is the counterparty to all futures contracts.

Swap Contracts

A swap is an agreement between two parties to exchange a series of cash flows at periodic settlement dates over a certain period of time. A swap may also be looked upon as a series of forward contracts.

Option Contracts

Option contracts give their holders the right to buy or sell a security at a predetermined price (exercise price) some time in the future.

- **Call options** give their holders the right to purchase the underlying asset at some future date at the option's exercise price. Holders are likely to exercise their call options when the price of the underlying asset is greater than the exercise price.
- **Put options** give their holders the right to sell the underlying asset at some future date at the option's exercise price. Holders are likely to exercise their put options when the price of the underlying asset is lower than the exercise price.

Options that can only be exercised at their expiration dates are known as European options, while options that can be exercised anytime until or at their expiration dates are known as American options.

Other Contracts

People often enter into insurance contracts to protect themselves from unexpected losses. Insurance contracts include credit default swaps (CDSs) that promise to pay their holders the amount of principal in case a company defaults on its bonds.

Commodities

Commodities include precious metals, energy products, industrial metals, agricultural products, and carbon credits.

Commodities may trade in the spot market (for immediate delivery) or in the forward or futures market (for delivery in the future). The primary traders in commodities spot markets are producers and processors of industrial metals and agricultural products as they have the ability to store the physical products and take or make delivery. Further, as part of their normal business operations, they obtain information that gives them an advantage as information-motivated traders.

Investment managers and other information-motivated traders participate in commodity futures markets to hedge risks and/or to speculate on future prices. These traders usually deal in futures markets, as they do not have the capacity to handle the physical products. Further, the fact that futures markets are relatively more liquid enables them to close or exit their positions easily.

Real Assets

Real assets include tangible properties such as real estate, airplanes, machinery, and lumber stands. These assets are normally held by operating companies (e.g., real estate developers and airplane leasing companies). However, institutional investors are increasingly adding them to their portfolios either directly (through direct ownership of the asset), or indirectly (through investments in securities of companies that invest in these assets). Real assets are attractive because:

- They may have low correlations with other assets in the investor's portfolio, thus providing diversification benefits.
- They offer income and tax benefits to investors.

However, real asset valuation is very difficult due to the heterogeneous nature of each investment. Further, real assets tend to be relatively illiquid and entail high management costs.

Indirect investments in real estate can be made by purchasing shares in real estate investment trusts (REITs) and master limited partnerships (MLPs). These entities pool funds from investors and invest in different types of real estate. Because these securities are relatively more homogeneous and divisible than the underlying real assets, they trade in relatively liquid markets.

LOS 45d: Describe types of financial intermediaries and services that they provide. Vol 5, pp 28–38

Financial intermediaries allow buyers and sellers of assets and contracts to transfer risk and capital between them, often without any knowledge of each other. Financial intermediaries include the following:

Brokers, Exchanges, and Alternative Trading Systems

Brokers are agents who fulfill orders for their clients. They reduce costs of trading for their clients by finding counterparties for their trades.

- *Block brokers* provide brokerage services to large traders. It is difficult to fulfill large orders, as there are not many potential counterparties for large trades. In order to induce counterparties to trade, large buy orders generally execute at a premium, while large sell orders generally trade at a discount to market prices. Large trades, if known to the public before being executed, may have a significant impact on market price and therefore must be managed carefully.
- *Investment banks* provide a variety of services to companies, including:
  - Arranging initial and seasoned security offerings.
  - Issuing securities to finance their business.
  - Identifying and acquiring other companies.

Exchanges provide a platform where traders can carry out their trades. Over time, the distinction between exchanges and brokers has become rather vague, as electronic order matching systems are increasingly being used by both to arrange trades for clients.

Alternative Trading Systems (ATSs) (also known as electronic communications networks [ECNs] and multilateral trading facilities [MTFs]) are trading venues just like exchanges. However, they differ from exchanges in that they do not exercise regulatory authority over their members except with respect to the conduct of their trading in their trading networks. Many ATSs are known as "dark pools" because they do not display orders sent to them.

Dealers

Unlike brokers, dealers fulfill orders for their clients by actually taking positions as counterparties for their trades. After executing a trade, they hope to close their positions by taking the opposite side of the original transaction with another client. Essentially, they indirectly connect two traders who arrive in the market at different points in time. By acting as counterparties to trades, dealers create liquidity in the market. They profit when their average purchase price is less than their average selling price.

Dealers may also often act as brokers and vice-versa, so practitioners often use the term **broker-dealer** to refer to brokers and dealers. Sometimes however, there may be a conflict of interest with respect to how broker-dealers fill orders. As brokers they must strive to find the best possible price for their clients, but as dealers they aim to maximize their own profits. Therefore, customers often specify how they want their orders to be filled (whether they want it filled by the broker or traded with another trader) when dealing with a broker-dealer.

Dealers with whom the central bank trades when conducting monetary policy are referred to as **primary dealers**. The central bank buys from and sells securities to these dealers who then trade with other market participants.

Securitizers

Securitization is the process of buying assets, placing them in a pool, and issuing securities that represent ownership of the assets in the pool. Entities that undertake this process are known as securitizers. They create and sell securitized instruments and act as financial intermediaries by connecting borrowers and lenders.

Depository Institutions and Other Financial Corporations

Depository institutions include commercial banks, savings and loan banks, credit unions, and other institutions that gather funds from depositors and lend them to borrowers. These institutions pay interest to depositors and provide transaction services (check writing and check cashing, etc.) to them. Borrowers go to these institutions in the hope of borrowing funds from them.

Brokers also act as financial intermediaries when they lend funds deposited by their clients to other clients who wish to buy securities on margin. Such brokers are known as **prime brokers**.

Insurance Companies

Insurance companies create and sell contracts that protect buyers of these contracts from risks that they seek protection from. Basically, insurance companies provide a payment to the owner of the insurance policy if the risk that she is concerned with materializes and results in a loss. Examples of insurance contracts include auto, fire, theft, and life insurance contracts.

Insurance companies are financial intermediaries as they connect the buyers of insurance contracts with investors, creditors, and reinsurers who are willing to bear the insured risks. Insurance buyers benefit as they are able to transfer risks to entities that are willing to assume them, while owners, creditors, and reinsurers of the insurance company (who assume these risks) benefit from being able to sell their tolerance to risk without having to manage the contracts. Managing insurance contracts requires the insurance company to manage fraud, moral hazard, and adverse selection.

- Fraud occurs when people deliberately report fake losses.
- Moral hazard occurs when people are less careful about avoiding losses, as they are covered by insurance.
- Adverse selection occurs as only those who are most at risk usually buy insurance.

Arbitrageurs

The law of one price states that two securities that generate identical cash flows in the future, regardless of future events, should have the same price today. Arbitrageurs are constantly on the lookout for violations of this law. They trade on mispricings until they are eliminated and asset prices converge to their "correct levels."

Arbitrageurs, who buy and sell the same security in two different markets (at different prices), act as financial intermediaries as they effectively connect sellers in one market with buyers in another market. They also bring liquidity to markets.

Settlement and Custodial Services

Clearinghouses arrange for the final settlement of trades. They also serve as guarantors of performance in futures markets and as escrow agents in other markets. Further, they ensure that their members have adequate capital to settle trades, and also place limits on the aggregate net order quantities (buy minus sell) of their members. All of these functions performed by the clearinghouse help limit counterparty risk.

Banks and broker-dealers may offer custodial services for holding securities on behalf of their clients. This helps prevent the loss of securities through fraud or oversight.

LOS 45e: Compare positions an investor can take in an asset. Vol 5, pp 38–41

A **position** in an asset refers to the quantity of the asset that an entity owns or owes.

- A person with a long position owns an assets or a contract. She benefits when there is an increase in the price of the asset or contract.
- A person with a short position has sold an asset that she does not own, or has written or sold a contract. She benefits when there is a decrease in the price of the asset or contract.

Short positions are usually taken by information-motivated traders who believe that an asset or a contract will decrease in value. However, they may also be taken by hedgers who seek to eliminate/reduce a pre-existing risk. For example, a person holding gold inventories faces the risk of a fall in the price of gold. In order to protect herself from the risk of a fall in gold prices, she will take a short position on gold futures contracts. If the price of gold falls, she would incur a loss on her inventory of gold, which would be offset by a profit on her short futures position.

Positions on Forwards and Futures

The long position in a forward or a futures contract is the side that is obligated to take physical delivery of the asset or its cash equivalent at contract expiration. She will benefit from an increase in the price of the underlying asset.

The short position in a forward or a futures contract is the side that is obligated to make physical delivery of the asset or its cash equivalent at contract expiration. She will benefit from a decrease in the price of the underlying asset.

Positions on Options

The long position on an options contract is the party that holds the right to exercise the option. The short side refers to the writer of the option, who must satisfy any obligations arising from the contract.

- The long position on a call option will benefit when the underlying rises in value.
- The short position on a call option will benefit when the underlying falls in value.
- The long position on a put option will benefit when the underlying falls in value.
- The short position on a put option will benefit when the underlying rises in value.

Swap Contracts

The two parties in a swap contract simply agree to exchange contractually determined cash flows. There is no real buyer or seller, which makes it difficult to determine the long and short side of the contract. Usually, the party that benefits from an increase in the quoted price is referred to as the long.

Currency Contracts

A party that purchases one currency simultaneously sells another currency (the other currency in the price quote or exchange rate). Therefore, whenever we mention a long or a short position in a currency contract, we must mention the other currency as well. For example, we may state that a party is long on the dollar against the yen.

Short Positions

Short positions in contracts are created by selling contracts that the short seller does not own. The short seller is basically the issuer of the contract. For example, a company creates a short position on bonds (a contract between the company and bondholders or lenders) when it issues bonds in exchange for cash.

Short positions in securities are created by selling securities that the short seller does not own. In order to sell the securities, the short seller borrows the securities from long holders to deliver them to buyers. To unwind the position, the short seller then repurchases the security (hopefully at a lower price) from the market and returns it to the long holder.

The maximum profit for the holder of a long position on an asset is unlimited, while her losses are limited to the price she purchased the asset for. In contrast, the maximum profit for a short seller of an asset is limited to her selling price, while her losses are unlimited.

LOS 45f: Calculate and interpret the leverage ratio, the rate of return on a margin transaction, and the security price at which the investor would receive a margin call. Vol 5, pp 41–44

Levered Positions

Many markets allow investors to borrow funds from brokers to purchase securities. The investor borrows a portion of the price of the stock, contributes the rest of the funds herself, and puts up the stock as collateral. The borrowed money is known as the margin loan and the interest rate paid on it is the call money rate.

Traders who purchase securities on margin face minimum margin requirements. The initial margin requirement refers to the proportion of the total cost of the asset that an investor must invest with her own equity. This requirement may be determined by the government, the exchange, or the clearinghouse.

When traders borrow money to purchase securities, they are said to be leveraging their positions. The leverage ratio is the ratio of the value of the position to the value of the equity investment in it. The maximum leverage ratio for a position financed by a margin loan equals one divided by the minimum margin requirement.

Leverage enhances a trader's returns, but also magnifies losses, as illustrated in Example 1-1.

Example 1-1: Computing Total Return to a Leveraged Stock Purchase

Susan purchases 100 shares of Alpha Corp on margin for $30 per share. She sells her shares after one year at $24 per share. The following information is also available:

Dividend received on the stock = $0.30 per share
Commission paid = $0.10 per share
Leverage ratio = 2.0
Call money rate = 6%

1. What is the total return on this investment?
2. Why is the loss greater than the 20% decrease in the market price?

Solution

1. Total purchase price = 100 × 30 = $3,000

   Using her leverage ratio, we can calculate her equity investment as follows:

   Equity investment = 1 / 2.0 = 50%

   Therefore, she borrowed $1,500 ($3,000 × 50%).

   Commission paid on purchase transaction = 100 × 0.1 = $10

   Therefore, her total initial investment = $1,500 + 10 = $1,510

   Equity remaining after the sale is computed as follows:

Initial investment	$1,510
Purchase commission	−10
Trading gains/losses [(24 × 100) − 3,000]	−600
Margin interest paid (1,500 × 0.06)	−90
Dividends received (0.3 × 100)	30
Sales commission paid	−10
Remaining equity	$830
or	
Proceeds on sale (24 × 100)	2,400
Payoff loan	−1,500
Margin interest paid	−90
Dividends received	30
Sales commission paid	−10
Remaining equity	$830

   Therefore, total return = (830 − 1,510) / 1,510] = −45.03%

2. The realized loss is greater than the 20% decrease in the market price primarily because of leverage and also because of interest paid on borrowed funds. Based on leverage alone (i.e., ignoring the other cash flows), the expected return on equity would be −40% (= 2.0 × −20%).

In addition to the initial margin requirement, traders who invest on margin must also adhere to maintenance margin requirements. After the purchase of a stock, an increase or decrease in the price translates into a change in the value of the collateral backing the margin loan. If the proportion of the value of the security financed by the investor's own equity (after adjusting for the price change) falls below the maintenance margin, the investor will receive a margin call, and she would have to deposit enough funds into her account to at least meet the maintenance margin level. If she fails to do so, her broker can sell the stock to pay off the margin loan. See Example 1-2.

The price at which an investor who goes long on a stock receives a margin call is calculated as:

$$P_0 \times \frac{(1 - \text{Initial margin})}{(1 - \text{Maintenance margin})}$$

Example 1-2: Margin Calls

Determine the share price at which an investor will receive a margin call given that the share price at the time of purchase was $60, the initial margin requirement is 50%, maintenance margin is 25%, and the investor has purchased 200 shares.

Solution

$$\text{Trigger price} = \frac{\$60(1 - 0.5)}{1 - 0.25} = \$40$$

The investor will receive a margin call when the stock price falls to $40.

Traders who sell securities short are also subject to margin requirements, as they have borrowed securities to take their positions.

LESSON 2: ORDERS, PRIMARY AND SECONDARY SECURITY MARKETS, AND MARKET STRUCTURES

LOS 45g: Compare execution, validity, and clearing instructions. Vol 5, pp 44–50

LOS 45h: Compare market orders with limit orders. Vol 5, pp 44–46

The prices at which dealers and other proprietary traders are willing to buy securities are called bid prices and those at which they are willing to sell are called ask (or offer) prices. The quantities that market participants are willing to trade at the bid and ask prices are called bid sizes and ask sizes respectively.

The highest bid in the market is the highest price that a dealer is willing to pay for the security and is known as the best bid. On the other hand, the lowest ask price is the best offer. The difference between the best bid and the best offer is the market bid-ask spread. Liquid markets with low transaction costs generally have small bid-ask spreads.

Execution Instructions

Execution instructions indicate how an order should be filled. They include:

- Market orders, which instruct brokers or the exchange to fill an order immediately at the best available price. Market orders generally execute immediately as long as there are traders willing to take the other side of the trade. However, they may be expensive to execute, especially when the order size is large relative to the normal trading activity in the market.
- Limit orders, which instruct the broker or the exchange to fill an order at a specified price or better. These specified prices (maximum price for a limit buy order and minimum price for a limit sell order) are referred to as limit prices. Limit orders prevent trades from executing at unacceptable prices. However, this also means that they may not execute at all if the limit price on a buy order is too low or the limit price on a sell order is too high.
    - A limit buy order is aggressively priced when the limit price is high relative to the market "bid" and "ask" prices.
    - A limit buy order placed above the best offer is likely to be at least partially executed immediately and is called a marketable limit order.
    - A limit buy order placed above the best bid but below the best offer is said to have created a new market by establishing the new best bid.
    - A limit buy order placed at the best bid is said to make market. This order will have to wait for all buy orders (that were placed earlier) at that price to execute first.
    - A limit buy order placed below the best bid is referred to as behind the market and will not execute unless market prices drop. These orders are known as standing limit orders.

Although aggressively priced orders execute sooner, the prices at which they trade are inferior.

Some execution instructions include limitations on order size. For example, all-or-nothing orders (AON) can only trade if their entire sizes can be traded. Traders can also specify minimum fill sizes.

Exposure Instructions

Exposure instructions specify whether, how, and to whom orders may be exposed.

Hidden orders are exposed only to the brokers or exchanges that receive them. Other traders can discover hidden size only after submitting orders that will trade with that size. However, hidden orders may not execute at all as other traders do not know about them. Therefore, traders may sometimes indicate a specific display size (which is lower than the actual order size) with their orders to signal to other traders that someone is willing to trade at the displayed price. As most of the order size is hidden, these orders are also referred to as iceberg orders.

Validity Instructions

Validity instructions indicate when an order may be filled. They include:

- Day orders, which are only valid for the day on which they are submitted. These orders expire if not filled at the close of business.
- Good-till-cancelled orders, which are valid until cancelled by the broker.
- Immediate or cancel orders, which may only be filled, completely or in part, immediately and are otherwise cancelled. These are also known as fill or kill orders.
- Good-on-close orders, which only execute at the close of trading and are also called market-on-close orders.
- Stop orders (often referred to as stop-loss orders), which are placed by investors to protect themselves from adverse price movements. A stop-loss buy order is placed by short sellers above the market price. If the price of the asset moves against the short seller's expectations, the stop buy order will ensure that her losses do not exceed a particular limit. For example, if Veronica goes short on a stock that is currently priced at $50, she might place a stop buy order at $55. If the stock were to move up to $55, her stop loss buy order would execute and limit her loss to $5. On the other hand, a trader who is bullish on the market would place a stop-sell order below the current market price. If prices were to move down contrary to her expectations, the stop-sell order would limit her losses.

Clearing Instructions

Clearing instructions indicate how the final settlement of trades should be arranged. They include details of the entities responsible for clearing and settling the trade. Further, security sale orders must also indicate whether the sale is a long sale or a short sale.

LOS 45i: Define primary and secondary markets and explain how secondary markets support primary markets. Vol 5, pp 50–53

Primary Markets

Primary markets are markets where issuers first sell their securities to investors. When a security is issued to the public for the first time, it is referred to as an initial public offering (IPO). On the other hand, when additional units of a previously issued security are sold, it is referred to as a seasoned offering (or a secondary offering) and the issue is called a seasoned issue.

Public Offerings

Companies generally issue securities to the public through an investment bank. The investment bank performs the following functions:

- Through a process called book building, it lines up subscribers who wish to purchase the security.
- It provides investment information about the issuer to its clients and to the public.

The issuer's arrangement with the investment bank may take one of the following forms:

- In an underwriting offer, the investment bank guarantees the sale of the issue at an offering price negotiated with the issuer. If the issue is not fully subscribed, the investment bank commits to purchasing the leftover securities at the offer price.
- In a best efforts offering, the investment bank merely acts as a broker. It tries its best to sell the securities at the negotiated price, but does not promise to purchase unsold securities.

Underwritten offerings lead to a conflict of interest for investment banks regarding pricing. As an agent the investment bank must strive to obtain the best (highest) possible price for issuers. However, since the investment bank is obligated to purchase leftover securities in case the issue is not fully subscribed, it would prefer the issue to be priced lower.

First-time issuers usually accept relatively low offer prices because they do not want to leave their issue undersubscribed as it sends out a negative signal about the company. For seasoned issues, it is easier to determine the price as the securities are already being traded in the secondary market.

Private Placements

In a private placement securities are not offered to the public. Companies sell securities directly to a group of qualified investors, usually through an investment bank. Qualified investors are generally those who understand associated risks and have sufficient wealth to withstand significant losses. Private placements are typically cheaper than public offerings as they do not require as much public disclosure. However, since privately placed securities do not trade on organized secondary markets, investors require a higher rate of return from them.

Other Primary Market Transactions

- Companies that issue securities via a *shelf registration* make all the public disclosures that are required in a regular offering, but they do not need to issue all the shares at once. They can sell them directly in the secondary market over time, which offers them flexibility as they can raise capital when they need it.
- Companies that issue securities through *dividend reinvestment plans (DRPs)* allow shareholders to reinvest their dividends by purchasing shares of the company. These shares may be newly issued or purchased from the open market.
- Companies sometimes offer *rights* to existing shareholders to purchase additional shares of the company in proportion to their current holdings at a fixed price.

Secondary Markets

The **secondary market** is that part of the financial market where previously issued securities and financial instruments are traded. Secondary markets play a very important role in that they provide liquidity to investors who purchased their securities in the primary market. Investors will hesitate to participate in the primary market if they cannot subsequently sell their holdings in the secondary market.

Secondary markets are also important for seasoned security issuers, as the prices of their new offerings are derived from the secondary market prices of currently outstanding securities that trade on the secondary market.

LOS 45j: Describe how securities, contracts, and currencies are traded in quote-driven, order-driven, and brokered markets. Vol 5, pp 54–58

Trading Sessions

In a call market, all bid and ask prices for an asset are gathered to determine one price where the quantity offered for sale is close to the quantity demanded. All transactions take place at this single price. Call markets are popular in smaller markets. However, they are also used on larger exchanges to determine the opening price of a trading session.

In a continuous market, transactions can take place whenever the market is open. Prices are set either through an auction process or by dealer bid-ask quotes. Most global stock exchanges are continuous markets.

The advantage of a call market is that it makes it easier for buyers and sellers to find each other by gathering all traders at the same place at the same time. In a continuous market, if a buyer and seller (or their orders) are not present at the same time, they cannot trade. The advantage of a continuous market is that a willing buyer and seller can trade anytime the market is open. In a call market they would only be able to trade when the market is called.

Execution Mechanisms

A pure auction market (order-driven market) is one where participants submit their bid and ask prices to a central location. Matching bids and offers are paired together and orders are executed. Order-driven matching mechanisms are characterized by two sets of rules:

- Order matching rules match buy orders to sell orders. They rank buy and sell orders based on:
  - Price precedence: Highest priced buy orders and lowest priced sell orders are ranked first.
  - Display precedence: Displayed quantities have precedence over undisplayed quantities at the same price.
  - Time precedence: Orders that arrived first have precedence over orders that arrived later with the same price and with the same display status.
- Trade pricing rules determine the prices at which matched trades take place. Prices may be determined based on the any of the following:
  - Under a uniform pricing rule, the same price is used for all trades. This rule is used by call markets where the market chooses the price that maximizes total quantity traded.
  - Under a discriminatory pricing rule, the limit price of the order or quote that arrived first (the standing order) determines the trade price. Continuous trading markets use this rule.
  - A derivative pricing rule uses the mid-point of the best bid and ask quotes from another market. Crossing networks (which may themselves be organized as call or continuous trading markets) use this pricing rule.

Crossing networks are trading systems that match buyers and sellers who are willing to trade at prices obtained from other markets.

A dealer market (quote-driven market or price-driven market) consists of individual dealers who are assigned specific securities. These dealers create liquidity by purchasing and selling against their own inventory of securities. Competition between dealers ensures that competitive prices are available.

In a brokered market, brokers arrange trades among their clients. Brokers organize markets for unique items (e.g., real estate properties and fine art masterpieces) that only interest a limited number of people.

Market Information Systems

Markets may be structured based on the type and quantity of information they disseminate to the public.

- Pre-trade transparent markets publish real-time data about quotes and orders.
- Post-trade transparent markets publish data about trade prices soon after trades occur.

LESSON 3: WELL-FUNCTIONING FINANCIAL SYSTEMS AND MARKET REGULATION

LOS 45k: Describe characteristics of a well-functioning financial system.

Vol 5, pp 58–60

As mentioned previously, a well-functioning financial system helps:

- Investors to save for the future.
- Entities to borrow funds.
- Hedgers to manage various risks.
- The exchange of assets by creating liquidity in spot markets.

A financial system helps to achieve these goals by establishing financial markets and financial intermediaries. A financial market is a platform that brings together buyers and sellers to facilitate transfers of assets. A well-functioning securities market has the following features:

- **Timely and accurate disclosures** so that market participants can make well-informed decisions.
- **Liquidity** so that costs of trading are minimized.
- **Complete markets** that allow people solve their financial problems.
- **External or informational efficiency**, where prices respond to changes in fundamental values.

If all the assets or contracts needed to achieve these four objectives are available to trade, the financial system is said to have complete markets.

If the costs of trading are low, the financial market is said to be operationally efficient.

If assets and contracts are properly priced (given all available relevant information) the financial market is said to be informationally efficient.

Financial intermediaries are also an integral part of the financial system. They:

- Match buyers and sellers by organizing trading venues, such as exchanges, brokerages, alternative trading systems, and so on.
- Provide liquidity.
- Lower borrowing costs by securitizing assets.
- Manage banks that match investors and borrowers by taking deposits and making loans.
- Manage insurance companies that pool uncorrelated risks.
- Provide investment advisory services to investors at a low cost.
- Organize clearinghouses that ensure the settlement of trades.
- Organize depositories that ensure safety of assets.

A well-functioning financial system leads to informationally efficient prices. Market participants analyze securities and push up (push down) prices of undervalued (overvalued) securities. However, this depends on the cost of obtaining fundamental information and market liquidity.

- Accounting standards help to lower the cost of obtaining relevant information by requiring companies to make timely financial disclosures.
- Liquid markets enable traders to act on that information and make investment decisions.

As a result of efficient markets, capital is allocated to its most productive use in society (i.e., allocative efficiency is reached).

LOS 45l: Describe the objectives of market regulation. Vol 5, pp 61–63

The following problems could arise in financial markets if they were left unregulated:

- Fraud and theft.
- Insider trading.
- Increase in the cost of information.
- Increase in the number of defaults.

In light of these problems, it is imperative that financial markets are regulated. Regulation of the financial system has the following objectives:

- To control fraud or deception of market participants.
- To control agency problems by setting minimum standards of competence for agents and by defining and enforcing minimum standards of practice.
- To promote fairness by creating a level playing field for market participants.
- To set mutually beneficial standards for financial reporting.
- To prevent undercapitalized financial firms from exploiting their investors by making excessively risky investments.
- To ensure that long-term liabilities are funded. For example, regulation seeks to ensure that insurance companies and pension funds have sufficient capital to honor their long term commitments.

Regulation may be provided by governments or industry groups (self-regulating organizations or SROs).

READING 46: SECURITY MARKET INDICES

LESSON 1: INDEX DEFINITION, CALCULATIONS, CONSTRUCTION, AND MANAGEMENT

LOS 46a: Describe a security market index. Vol 5, pp 78–79

A **security market index** consists of individual securities (also called constituent securities) that represent a given security market, market segment, or asset class. Each security market index may have two versions depending on how returns are calculated:

- A price return index only reflects the prices of constituent securities.
- A total return index not only reflects prices, but also assumes reinvestment of all income received since inception.

The values of both versions of an index are the same at inception. However, as time passes, the total return index will be greater in value than the price return index by an increasing amount.

LOS 46b: Calculate and interpret the value, price return, and total return of an index. Vol 5, pp 79–82

The value of a price return index is calculated as follows:

$$V_{PRI} = \frac{\sum_{i=1}^{N} n_i P_i}{D}$$

where:
V_{PRI} = Value of the price return index
n_i = Number of units of constituent security i held in the index portfolio
N = Number of constituent securities in the index
P_i = Unit price of constituent security i
D = Value of the divisor

The divisor is initially chosen as a value that gives the index a convenient initial value (e.g., 1,000). However, over time the divisor must be adjusted to ensure that changes in the index only reflect changes in prices of constituent securities. For example, if some constituent securities are replaced by others in the index, the divisor must be adjusted so that the value of the index remains unchanged.

Index return calculations may measure price return or total return:

- Price return measures only the percentage change in price.
- Total return measures the percentage change in price plus interest, dividends, and other distributions.

Calculation of Single Period Returns

Price Return

The price return of an index can be calculated as:

$$PR_I = \frac{V_{PRI1} - V_{PRI0}}{V_{PRI0}}$$

where:
PR_I = Price return of the index portfolio (as a decimal number)
V_{PRI1} = Value of the price return index at the end of the period
V_{PRI0} = Value of the price return index at the beginning of the period

The price return of each constituent security is calculated as:

$$PR_i = \frac{P_{i1} - P_{i0}}{P_{i0}}$$

where:
PR_i = Price return of constituent security i (as a decimal number)
P_{i1} = Price of the constituent security i at the end of the period
P_{i0} = Price of the constituent security i at the beginning of the period

The price return of the index equals the weighted average price return of the constituent securities. It is calculated as:

$$PR_I = w_1PR_1 + w_2PR_2 + \ldots + w_NPR_N$$

where:
PR_I = Price return of the index portfolio (as a decimal number)
PR_i = Price return of constituent security i (as a decimal number)
w_i = Weight of security i in the index portfolio
N = Number of securities in the index

Total Return

The total return of an index can be calculated as:

$$TR_I = \frac{V_{PRI1} - V_{PRI0} + Inc_I}{V_{PRI0}}$$

where:
TR_I = Total return of the index portfolio (as a decimal number)
V_{PRI1} = Value of the total return index at the end of the period
V_{PRI0} = Value of the total return index at the beginning of the period
Inc_I = Total income from all securities in the index held over the period

The total return of each constituent security is calculated as:

$$TR_i = \frac{P_{1i} - P_{0i} + Inc_i}{P_{0i}}$$

where:
TR_i = Total return of constituent security i (as a decimal number)
P_{1i} = Price of constituent security i at the end of the period
P_{0i} = Price of constituent security i at the beginning of the period
Inc_i = Total income from security i over the period

The total return of the index equals the weighted average total return of the constituent securities. It is calculated as:

$$TR_I = w_1TR_1 + w_2TR_2 + ... + w_NTR_N$$

where:
TR_I = Total return of the index portfolio (as a decimal number)
TR_i = Total return of constituent security i (as a decimal number)
w_i = Weight of security i in the index portfolio
N = Number of securities in the index

Calculation of Index Returns over Multiple Time Periods

Given a series of price returns for an index, the value of a price return index can be calculated as (see Example 1-1):

$$V_{PRIT} = V_{PRI0}(1+PR_{I1})(1+PR_{I2})\ldots(1+PR_{IT})$$

where:
V_{PRI0} = Value of the price return index at inception
V_{PRIT} = Value of the price return index at time t
PR_{IT} = Price return (as a decimal number) on the index over the period

Similarly, the value of a total return index may be calculated as:

$$V_{TRIT} = V_{TRI0}(1+TR_{I1})(1+TR_{I2})\ldots(1+TR_{IT})$$

where:
V_{TRI0} = Value of the index at inception
V_{TRIT} = Value of the index at time t
TR_{IT} = Total return (as a decimal number) on the index over the period

Example 1-1: Price Return and Total Return Indices

An analyst obtained the following information regarding an equity market index created at the beginning of 2008:

	2008	2009
Price return	7.5%	8.3%
Total return	12.6%	13.4%

Given that the index value at inception is 1,000, calculate the values of price return and total return indices at the end of 2008 and 2009.

Solution

Price return index

Value at the end of 2008 = 1,000 × 1.075 = 1,075

Value at the end of 2009 = 1,000 × 1.075 × 1.083 = 1,164.225

Total return index

Value at the end of 2008 = 1,000 × 1.126 = 1,126

Value at the end of 2009 = 1,000 × 1.126 × 1.134 = 1,276.884

LOS 46c: Describe the choices and issues in index construction and management. Vol 5, pg 82

Constructing and managing a security market index involves:

- Target market selection.
- Security selection.
- Index weighting.
- Rebalancing.
- Reconstitution.

Target Market and Security Selection

When constructing a security market index, the first decision that must be made relates to which market, market segment, or asset class the index should represent. The target market may be based on:

- Asset class (e.g., equities, fixed income, or real estate)
- Geographic region (e.g., Japan, South Africa, or Europe)
- The exchange on which the securities are traded (e.g., New York, London, or Tokyo)
- Other characteristics (e.g., economic sector, company size, and investment style)

An index may consist of all the securities in the target market or just a representative sample of the target market. Some indices (e.g., S&P 500) fix the number of securities to be included in the index, while others (e.g., TOPIX) allow the number of securities to vary to reflect changes in the target market or to maintain a certain percentage of the target market.

LOS 46d: Compare the different weighting methods used in index construction. Vol 5, pp 82–91

LOS 46e: Calculate and analyze the value and return of an index given its weighting method. Vol 5, pp 82–91

Price Weighting

In a price-weighted index the weight of each constituent security is determined by dividing its price by the sum of the prices of all constituent securities:

$$w_i^P = \frac{P_i}{\sum_{i=1}^{N} P_i}$$

The value of a price-weighted index is computed by dividing the sum of the security prices by the divisor. See Example 1-2. At inception, the divisor is typically set to the number of securities in the index.

Example 1-2: Price-Weighted Index

A price-weighted equity index consists of one share each of five securities. The prices of these securities at the end of 2008 and 2009 are given below:

Securities	Price at the End of 2008 ($)	Price at the End of 2009 ($)
A	30	34
B	22	28
C	35	31
D	50	54
E	48	44

1. Calculate the value of the index at the beginning of 2009.
2. Calculate the weights of each security at the beginning of 2009.
3. Calculate the price return of the index for 2009.

In the examples relating to various weighting methods, we have concentrated on determining only the price return on the index to keep it simple. Total return index calculations are similar, the only difference being that total returns for each constituent security are used instead of price returns.

Solution

1. Value of the index at the beginning of 2009:

$$= \frac{(30\times1)+(22\times1)+(35\times1)+(50\times1)+(48\times1)}{5} = 37$$

2. Weight of security A = 30/185 = 16.22%
   Weight of security B = 22/185 = 11.89%
   Weight of security C = 35/185 = 18.92%
   Weight of security D = 50/185 = 27.03%
   Weight of security E = 48/185 = 25.95%

3. Value of the index at the end of 2009:

$$= \frac{(34\times1)+(28\times1)+(31\times1)+(54\times1)+(44\times1)}{5} = 38.2$$

   Price return of the index for 2009 = (38.2 – 37) / 37 = 3.24%

The advantage of a price-weighted index is its simplicity. One of the issues with a price-weighted index is that a stock split or stock dividend by one of the constituent securities changes the weights of all securities in the index. To prevent stock splits and stock dividends from changing the value of the index, the divisor of a price-weighted index must be adjusted. This is illustrated in Example 1-3.

Example 1-3: Calculation of Index Divisor After a Stock Split

A price-weighted market index includes four stocks: A, B, C, and D. Stock B issues a four-for-one stock split. The table below lists the prices of the stocks before and after the split.

Stock	Before Split	After Stock Split by Stock B
A	40	40
B	80	20
C	70	70
D	50	50
	240	**180**
		180 ÷ x = 60
	Index = 240 ÷ 4 = 60	x = 3

If the divisor is not adjusted for the stock split, the index will fall from 60 to 45 (180/4) even though there has been no change in prices other than to adjust for the split. To reflect the fact that stock values really have not changed, the index divisor must be adjusted. This new divisor, x, is calculated as (40 + 20 + 70 + 50) / 60 = 3.

Price-weighted indices suffer from a *downward* bias. Companies that split their stock are typically those that have witnessed substantial increases in their stock prices. As their stock prices fall to adjust for the split, their weight in the index also falls.

Equal Weighting

In an equal-weighted index, each constituent security is given an identical weight in the index at inception. The weights are calculated as:

$$w_i^E = \frac{1}{N}$$

where:
w_i = Fraction of the portfolio that is allocated to security i or weight of security i
N = Number of securities in the index

The number of shares of each security included in the index is calculated as the value allotted to each constituent security divided by the price of the security. Unlike a price-weighted index, where the weights are arbitrarily determined by market prices, the weights in an equal-weighted index are effectively determined by the index provider (in choosing the particular weighting mechanism). See Example 1-4.

Example 1-4: Equal-Weighted Index

An equal-weighted equity index with an initial value of 10,000 consists of five securities whose prices as at the end of 2008 and 2009 are given below:

Securities	Price at the End of 2008 ($)	Price at the End of 2009 ($)
A	30	34
B	22	28
C	35	31
D	50	54
E	48	44

1. Calculate the number of shares of each security included in the equal-weighted index.
2. Calculate the index value at the end of 2009.
3. Calculate the price return of the index for 2009.

Solution

Since the index consists of five securities, each security will be assigned a weight of 20% in the index. As the total value of the index is 10,000, the value assigned to each security will be 2,000.

1. Number of shares of Stock A = 2,000/30 = 66
   Number of shares of Stock B = 2,000/22 = 90
   Number of shares of Stock C = 2,000/35 = 57
   Number of shares of Stock D = 2,000/50 = 40
   Number of shares of Stock E = 2,000/48 = 41

   The number of shares of each security in this example has been rounded off for simplicity.

2. The value of the index position in each security at the end of 2009 is calculated as:

   Security A: 66 × 34 = 2,244
   Security B: 90 × 28 = 2,520
   Security C: 57 × 31 = 1,767
   Security D: 40 × 54 = 2,160
   Security E: 41 × 44 = 1,804

   Therefore, the total value of the index at the end of 2009 is calculated as:
   2,244 + 2,520 + 1,767 + 2,160 + 1,804 = 10,495

3. The price return of the index for 2009 = (10,495 / 10,000) – 1 = 4.95%

Equal-weighted indices are also preferred because of their simplicity. However, they have a few disadvantages:

- Assigning an equal weight to all securities under-represents (over-represents) those securities that constitute a relatively large (small) fraction of the target market.
- The index does not remain equally weighted once the prices of the constituent securities change. Frequent adjustments must be made to maintain equal weighting.

Market-Capitalization Weighting

A market-capitalization weighted (value weighted) index is based on the total market value (current stock price times the total number of shares outstanding) of all stocks in the index. The proportion of each constituent security is determined by dividing its market capitalization by the total market capitalization of all the securities in the index:

$$w_i^M = \frac{Q_i P_i}{\sum_{j=1}^{N} Q_j P_j}$$

where:
w_i = Fraction of the portfolio that is allocated to security i or weight of security i
Q_i = Number of shares outstanding of security i
P_i = Share price of security i
N = Number of securities in the index

The initial market value is assigned a base number (e.g., 100) and a new market value is computed periodically. The change in the index is measured by comparing the new market value to the base market value. See Example 1-5.

Example 1-5: Market Capitalization-Weighted Index

A market-capitalization-weighted equity index consists of five securities whose prices and number of shares outstanding are given below:

Securities	Price at the End of 2008 ($)	Price at the End of 2009 ($)	Shares Outstanding
A	30	34	4,000
B	22	28	6,000
C	35	31	2,000
D	50	54	2,500
E	48	44	3,000

1. Calculate the weight of each security in the index at the beginning of 2009.
2. Calculate the value of the divisor that gives an index value of 1,000 at the beginning of 2009.
3. Calculate the price return of the index for 2009.

Solution

1. Total market capitalization at the beginning of 2009:

   $= (30 \times 4{,}000) + (22 \times 6{,}000) + (35 \times 2{,}000) + (50 \times 2{,}500) + (48 \times 3{,}000) = 591{,}000$

   The weights of each of the 5 securities are calculated below:

   Security A = (30 × 4,000) / 591,000 = 20.30%
   Security B = (22 × 6,000) / 591,000 = 22.34%
   Security C = (35 × 2,000) / 591,000 = 11.84%
   Security D = (50 × 2,500) / 591,000 = 21.15%
   Security E = (48 × 3,000) / 591,000 = 24.37%

2. Value of the divisor = 591,000 / 1,000 = 591

3. Total market capitalization at the end of 2009:

   $= (34 \times 4{,}000) + (28 \times 6{,}000) + (31 \times 2{,}000) + (54 \times 2{,}500) + (44 \times 3{,}000) = 633{,}000$

   Price return of the index for 2009 = (633,000/591) / 1,000 – 1 = 7.11%

Value-weighted indices automatically adjust for stock splits and stock dividends.

Float-Adjusted Market-Capitalization Weighting

In a float-adjusted market-capitalization weighted index, the proportion of each constituent security is determined by adjusting its market capitalization for its market float.

Market float generally refers to the number of shares of the constituent security that are available to the investing public. Shares held by controlling shareholders, other corporations, and governments are subtracted from the total number of outstanding shares to determine the market float. See Example 1-6.

The float-adjusted market-capitalization weight of each constituent security is calculated as:

$$w_i^M = \frac{f_i Q_i P_i}{\sum_{j=1}^{N} f_j Q_j P_j}$$

where:
f_i = Fraction of shares outstanding in the market float
w_i = Fraction of the portfolio that is allocated to security i or weight of security i
Q_i = Number of shares outstanding of security i
P_i = Share price of security i
N = Number of securities in the index

Example 1-6: Float-Adjusted Market-Capitalization Weighted Indices

A float-adjusted market-capitalization weighted equity index consists of five securities. Further information is provided in the table below:

Securities	Price at the End of 2008 ($)	Price at the End of 2009 ($)	Shares Outstanding	Percentage of Shares in Market Float
A	30	34	4,000	40
B	22	28	6,000	70
C	35	31	2,000	80
D	50	54	2,500	50
E	48	44	3,000	60

1. Calculate the number of shares of each security that will be included in the index.
2. Calculate the total float-adjusted market-capitalization at the beginning of 2009.
3. Calculate the price return of the index for 2009.

Solution

1. The number of shares of each security to be included in the index is calculated as:

   Security A = 4,000 × 40% = 1,600
   Security B = 6,000 × 70% = 4,200
   Security C = 2,000 × 80% = 1,600
   Security D = 2,500 × 50% = 1,250
   Security E = 3,000 × 60% = 1,800

2. The total float-adjusted market-capitalization at the beginning of 2009 is calculated as:

   $(30 \times 1{,}600) + (22 \times 4{,}200) + (35 \times 1{,}600) + (50 \times 1{,}250) + (48 \times 1{,}800) = 345{,}300$

3. The total float-adjusted market-capitalization at the end of 2009 is calculated as:

$$(34 \times 1{,}600) + (28 \times 4{,}200) + (31 \times 1{,}600) + (54 \times 1{,}250) + (44 \times 1{,}800) = 368{,}300$$

Price return of the index for 2009 = (368,300 / 345,300) – 1 = 6.66%

The primary advantage of market capitalization weighting (and float-adjusted market capitalization weighting) is that securities are held in proportion to their value in the target market. A disadvantage is that stocks with larger market values have a larger impact on the index. Stocks that have seen their prices rise (fall) will see their relative weight in the index increase (decline). The effect of market value weighting is therefore similar to that of a momentum trading strategy.

Fundamental Weighting

Instead of using prices of constituent securities, a fundamental weighted index uses other measures of a company's size (that are independent of the stock price) such as book value, cash flow, revenues, and earnings to determine weights of securities in the index. Some fundamental indices use a single measure to weight the constituent securities, while others combine weights from several measures to form a composite value that is used for weighting. See Example 1-7.

The fundamental weight on security i can be calculated as:

$$w_i^F = \frac{F_i}{\sum_{j=1}^{N} F_j}$$

where:
F_i = A given fundamental size measure of company i

Earnings yield equals earnings per share for the most recent 12-month period divided by the current market price per share. The earnings yield (which is the inverse of the P/E ratio) shows the percentage of each dollar invested in the stock that was earned by the company.

The earnings yield is used by many investment managers to determine optimal asset allocations.

Example 1-7: Fundamental Weighting

Consider two stocks, A and B, which are the only securities in an index. Market capitalization and earnings information for the stocks is given below:

	Stock A	Stock B	Total
Market capitalization ($)	1.4 billion	600 million	2 billion
Earnings ($)	40 million	40 million	80 million

The earnings yield of Stock A is 2.86% (0.04b/1.4b) and that of Stock B is 6.67% (40m/600m).

The weights assigned to the two stocks in a market-capitalization weighted and fundamental weighted index (based on earnings) are given next:

	Stock A	Stock B
Market-capitalization weighted	1.4/(1.4 + 0.6) = 70%	0.6 /(1.4 + 0.6) = 30%
Fundamental weighted	40/(40 + 40) = 50%	40/(40 + 40) = 50%

Notice that compared to a value-weighted index, a fundamental weighted index assigns a higher weight to Stock B (50% versus 30%) and a lower weight to Stock A (50% versus 70%). Stocks with a higher earnings yield than that of the overall market weighted portfolio will be more heavily weighted under fundamental weighting compared to market value weighting. Fundamental weighting therefore, results in a "value tilt."

In contrast to market-capitalization weighted indices, in which the weight of a stock in the index moves in the same direction as its price, fundamental weighted indices have a "contrarian" effect in that the portfolio weights move away from securities whose prices have risen (as higher prices result in a lower earnings yield).

LOS 46f: Describe rebalancing and reconstitution of an index. Vol 5, pp 91–93

Rebalancing

We have seen that the weights assigned to constituent securities at inception of an index change as their prices change. In order to keep the weights of constituent securities consistent with the index's weighting method, security weights must be adjusted or rebalanced.

- In equal-weighted indices, the weights of securities that have witnessed price appreciation increase over time, and weights of securities that have underperformed decrease over time. Rebalancing an equal-weighted index would require reducing the weight of securities that have outperformed and increasing the weight of securities that have underperformed.
- Price-weighted indices do not need to be rebalanced, as the weight of each constituent security is determined by its price.
- Market-capitalization weighted indices rebalance themselves to reflect changes in the market-capitalization of constituent securities. They only need to be rebalanced to reflect mergers, acquisitions, liquidations, and so on.

Reconstitution

This refers to the process of changing the constituent securities in an index. Constituent securities need to be examined on a regular basis to evaluate whether they still meet the criteria for inclusion in the index. If they no longer meet the criteria, they must be replaced with securities that do meet the criteria. Index reconstitution is performed in order to:

- Reflect changes in the target market as a result of bankruptcies, de-listings, mergers, and so on.
- Reflect the judgment of the selection committee.

Reconstitution creates turnover within the index (especially for market value weighted indices), as once the revised list of constituent securities is determined, the weights of all constituent securities must be recalculated. Further, the frequency of reconstitution is a major issue for widely used indices and their constituent securities. Even before a scheduled reconstitution is undertaken by the index provider, investors speculate on which securities will be added to or removed from the index. If investors bet on a particular security being added to a popular index (by purchasing significant quantities of that particular security), the stock can see a dramatic increase in its price before it is actually added to the index.

LESSON 2: USES OF MARKET INDICES AND TYPES OF INDICES

LOS 46g: Describe uses of security market indices. Vol 5, pp 93–95

- Indices are good indicators of the collective opinion of market participants and are used to gauge market sentiment. However, indices typically only include a sample of stocks and therefore do not reflect the behavior of investors who trade in other stocks.
- They are used as proxies for measuring and modeling returns, systematic risk, and risk-adjusted performance. For example, when applying the CAPM, the S&P 500 is used as a proxy for the market portfolio in the United States.
- By exhibiting the risk and return profiles of select groups of securities, indices act as proxies for asset classes in asset allocation models. They provide the historical data used to model the risks and returns of different asset classes.
- In the field of performance evaluation, indices are used as benchmarks for actively managed portfolios. For example, the performance of a portfolio consisting of global small-capitalization stocks might be compared to the performance of the FTSE Global Small Cap Index, which includes 4,600 small-capitalization stocks across 48 countries.
- Security market indices serve as the basis for the creation of numerous investment products. For example, they led to the development of index portfolios, which subsequently led to the introduction of exchange-traded funds (ETFs). ETFs in turn led to the development of new indices to serve the other needs of investors.

LOS 46h: Describe types of equity indices. Vol 5, pp 95–97

Equity indices include the following:

Broad market indices: A broad equity market index contains securities representing more than 90% of the selected market. For example, the Russell 3000 consists of the largest 3,000 stocks (by market capitalization), and represents 99% of the U.S. equity market.

Multi-market indices: Multi-market indices consist of security market indices from different countries and may represent multiple national markets, geographic regions, economic development groups, or even the entire world. A number of index providers, including MSCI-Barra publish multi-market indices. Index providers weight constituent securities in each country by market capitalization and determine the weight of each country in the overall index based on relative GDPs, effectively creating fundamental weighting in these indices.

Sector indices: Sector indices only include securities representing a particular economic sector (e.g., finance, health care, technology, etc.) where the economic sector may be classified on a national, regional, or global basis. These play an important role in evaluating a portfolio manager's performance and determining whether she is better at stock selection or sector allocation. Further, they serve as model portfolios for sector-specific ETFs and other investment portfolios.

Style indices: Financial firms like Dow Jones and Standard & Poor's have developed different indices based on specific investment strategies used by portfolio managers. These indices include those based on size (e.g., small-cap versus large-cap equities) and others based on style (e.g., growth versus value stocks). Stocks may need to be reclassified over time based on changing valuation ratios or market capitalizations. Therefore, style indices generally have much higher turnover than broad market indices.

LOS 46i: Describe types of fixed-income indices. Vol 5, pp 98–101

Creating bond-market indices presents the following challenges:

- There is a broader universe of bonds than of stocks.
- The universe of bonds is constantly changing as a result of new issues, calls, and maturities.
- The price volatility of a bond (as measured by duration) is constantly changing. Duration changes with a bond's maturity and market yields.
- Current and continuous transaction prices are not available for bonds.

Types of Fixed-Income Indices

Fixed-income securities can be classified along the following dimensions:

- Type of issuer (government, government agency, corporation).
- Type of financing (general obligation, collateralized).
- Currency of payments.
- Maturity.
- Credit quality (investment grade, high yield, credit agency ratings).
- Absence or presence of inflation protection.

Fixed-income indices can be categorized as follows:

- Aggregate or broad market indices.
- Market sector indices.
- Style indices.
- Economic sector indices.
- Specialized indices such as high-yield, inflation-linked, and emerging market indices.

Due to the wide variety of instruments, fixed-income indices may be subdivided based on a variety of dimensions. For example, indices categorizing securities as investment-grade and high-yield may be subdivided by maturity and credit rating.

LOS 46j: Describe indices representing alternative investments.
Vol 5, pp 101–104

Investments in asset classes other than equities and fixed-income have gained popularity as investors have looked to diversify their portfolios. Several indices have been created to represent the performance of these asset classes.

Commodity indices: Commodity indices consist of futures contracts on one or more commodities and have the following characteristics:

- They do not have an obvious weighting method so index providers create their own weighting methods. Commodities may either be weighted equally, or on the basis of price, or may have fixed weights as determined by a committee. The returns of different commodity indices that contain the same commodities may differ due to differences in weighting methods.
- Different weighting methods lead to different exposures to specific commodities, which result in very different risk and return profiles of commodity indices. Equity and fixed-income indices that target the same markets share similar risk and return profiles.
- The performance of commodity indices may differ from that of the underlying commodities because indices consist of futures contracts on commodities rather than the actual commodities. Aside from being affected by changes in prices of the underlying commodities, index returns are also affected by the risk-free rate, changes in futures prices, and roll yield.

Real estate investment trust indices: Real estate indices represent the market for real estate and real estate securities. They can be categorized as:

- Appraisal indices
- Repeat sales indices
- Real estate investment trust (REIT) indices

REIT indices consist of shares of publicly traded REITs (public or private organizations that combine individual investors' funds and provide them access to real estate investments). Shares issued by REITs trade on various exchanges around the world and are priced continuously.

Hedge fund indices: Hedge fund indices are designed to represent the performance of hedge funds (private investment vehicles that typically use leverage and long and short investment strategies) on a very broad, global level or the strategy level. Hedge fund indices have the following characteristics:

- They rely on voluntary disclosures from funds, as it is not mandatory for hedge funds to disclose performance to any party other than investors.

- If they do decide to disclose performance, hedge funds have a choice regarding which index or indices they report their performance to. Therefore, rather than index providers determining the constituents, the constituents determine the index. Further, different hedge fund indices may reflect very different performance for the hedge fund industry over the same period of time based on the hedge funds represented in those indices.
- Poorly performing hedge funds may stop reporting their performance to hedge fund indices or may cease to exist altogether. This leads to survivorship bias and an upward bias in hedge fund performance as represented by these indices.

LOS 46k: Compare types of security market indices. Vol 5, pp 103–104

Table 2-1: Representative Indices Worldwide[1]

As indicated in this reading, the choice of indices to meet the needs of investors is extensive. Investors using security market indices must be careful in their selection of the index or indices most appropriate for their needs. The following table illustrates the variety of indices reflecting different asset classes, markets, and weighting methods.

Index	Representing	Number of Securities	Weighting Method	Comments
Dow Jones Industrial Average	U.S. blue-chip companies	30	Price	The oldest and most widely-known U.S. equity index. Wall Street Journal editors choose 30 stocks from among large, mature, blue-chip companies.
Nikkei Stock Average	Japanese blue-chip companies	225	Modified price	Known as the Nikkei 225 and originally formulated by Dow Jones & Co. Because of extreme variations in price levels of component securities, some high price shares are weighted as a fraction of share price. Index contains some illiquid stocks.
TOPIX	All companies listed on the Tokyo Stock Exchange First Section	Varies	Float-adjusted market cap	Represents about 93 percent of the market value of all Japanese companies. Contains a large number of very small, illiquid stocks, making exact replication difficult.
MSCI All Country World Index	Stocks of 23 developed and 22 emerging markets	Varies	Free-float-adjusted market cap	Composed of companies representative of the market structure of developed and emerging market countries in the Americas, Europe/Middle East, and Asia/Pacific regions. Price return and total return versions available in both USD and local currencies.

1 - Representative Indices Worldwide, Volume 5, CFA Program Curriculum 2017

Table 2-1: Representative Indices Worldwide (continued)

Index	Representing	Number of Securities	Weighting Method	Comments
S&P Developed Ex-U.S. BMI Energy Sector Index	Energy sector of developed global markets outside the United States	Varies	Float-adjusted market cap	Serves as a model portfolio for the SPDR® S&P Energy Sector Exchange-Traded Fund (ETF).
Barclays Capital Global Aggregate Bond Index	Investment-grade bonds in the North American, European, and Asian markets	Varies	Market cap	Formerly known as Lehman Brothers Global Aggregate Bond Index
Markit iBoxx Euro High-Yield Bond Indices	Sub-investment-grade euro-denominated corporate bonds	Varies	Market cap and variations	Rebalanced monthly. Represents tradable part of market. Price and total return versions available with such analytical values as yield, duration, modified duration, and convexity. Provides platform for research and structured products.
FTSE EPRA/ NAREIT Global Real Estate Index	Real estate securities in the North American, European, and Asian markets	335	Float-adjusted market cap	The stock of REITs that constitute the index trade on public stock exchanges and may be constituents of equity market indices.
HFRX Global Hedge Fund Index	Overall composition of the HFR database	Varies	Asset weighting	Comprise all eligible hedge fund strategies. Examples include convertible arbitrage, distressed securities, market neutral, event driven, macro, and relative value arbitrage. Constituent strategies are asset weighted on the basis of asset distribution within the hedge fund industry.
HFRX Equal Weighted Strategies EUR Index	Overall composition of the HFR database	Varies	Equal weighting	Denominated in euros and is constructed from the same strategies as the HFRX Global Hedge Fund Index.
Morningstar Style Indices	U.S. stocks classified by market cap and value/ growth orientation	Varies	Float-adjusted market cap	The nine indices defined by combinations of market cap (large, mid, and small) and value/growth orientation (value, core, growth) have mutually exclusive constituents and are exhaustive with respect to the Morningstar U.S. Market Index. Each is a model portfolio for one of the iShares Morningstar ETFs.

READING 47: MARKET EFFICIENCY

LESSON 1: THE CONCEPT OF MARKET EFFICIENCY AND FORMS OF MARKET EFFICIENCY

LOS 47a: Describe market efficiency and related concepts, including their importance to investment practitioners. Vol 5, pp 117–119

An informationally efficient market (an efficient market) is one where security prices adjust rapidly to reflect any new information. It is a market where asset prices reflect all past and present information.

Investment managers and analysts are interested in market efficiency because it dictates how many profitable trading opportunities may abound in the market.

- In an efficient market, it is difficult to find inaccurately priced securities. Therefore, superior risk-adjusted returns cannot be attained in an efficient market, and it would be wise to pursue a passive investment strategy, which entails lower costs.
- In an inefficient market, securities may be mispriced and trading in these securities can offer positive risk-adjusted returns. In such a market, an active investment strategy may outperform a passive strategy on a risk-adjusted basis.

In an efficient market, the time frame required for security prices to reflect any new information is very short. For example, in the foreign exchange market and developed equity markets, prices reflect new information in less than a minute. In a relatively inefficient market, the time frame of the price adjustment is long enough to allow many traders to earn profits with little risk.

Finally, in an efficient market, prices only adjust to new or unexpected information (surprises). Investors absorb the new information and revise their expectations regarding the security's risk and return accordingly. They then take positions on the asset in light of their new forecasts. If the expected return is adequate compensation for the security's perceived risk, investors will purchase the asset, and if the expected return does not offer sufficient compensation for the asset's perceived risk, they will liquidate positions in the asset or even short it.

LOS 47b: Distinguish between market value and intrinsic value. Vol 5, pp 119–120

The market value or market price of the asset is the price at which the asset can currently be bought or sold. It is determined by the interaction of demand and supply for the security in the market. Intrinsic value or fundamental value is the value of the asset that reflects all its investment characteristics accurately. Intrinsic values are estimated in light of all the available information regarding the asset; they are not known for certain.

In an efficient market, investors widely believe that the market price reflects a security's intrinsic value. On the other hand, in an inefficient market, investors may try to develop their own estimates of intrinsic value in order to profit from any mispricing (difference between the market price and intrinsic value).

The challenge for investors lies in estimating an asset's intrinsic value. Estimates of intrinsic value are derived by forecasting the amount and timing of the security's future cash flows, and then discounting them at an appropriate discount rate (which reflects the

riskiness of these cash flows). As new, relevant information continues to flow to investors, estimates of intrinsic value and market prices keep changing.

LOS 47c: Explain factors that affect a market's efficiency. Vol 5, pp 120–124

Markets cannot strictly be classified as efficient or inefficient. Market efficiency should be viewed as falling on a continuum between these two extremes. A relatively efficient market reflects new information in market prices more quickly and more accurately than a relatively inefficient market.

Factors Contributing to and Impeding a Market's Efficiency

Market participants: Generally speaking, the greater the number of active market participants (investors and financial analysts) that analyze an asset or security, the greater the degree of efficiency in the market. Restrictions that prevent investors from trading in a market or in a particular security impede market efficiency.

Information availability and financial disclosure: The availability of accurate and timely information regarding trading activities and traded companies contributes to market efficiency. For a market to be considered efficient, investors should have access to the information necessary to value securities that trade in the market. Further, all investors should have fair and equal opportunity to act on this information.

Limits to trading: The activities of arbitrageurs, who seek opportunities to trade on mispricings in the market to earn arbitrage (riskless) profits, contribute to market efficiency. Arbitrageurs purchase securities that they believe are undervalued (bidding their prices up to their intrinsic values) and short securities that they believe are overvalued (bringing their prices down to their intrinsic values). Limitations on arbitrage trading (e.g., difficulty in executing trades immediately and high costs of trading) reduce market efficiency.

Transaction costs and information-acquisition costs: Investors should consider transaction costs and information-acquisition costs in evaluating the efficiency of a market.

Two securities that should trade for the exact same price in an efficient market may trade at different prices if the costs of trading on the mispricing (to make a profit) for the lowest-cost traders are greater than the potential profit. In such cases, these prices are still "efficient" within the bounds of arbitrage. The bounds of arbitrage are relatively narrow in highly liquid markets (e.g., U.S. T-bills), but wider in relatively illiquid markets.

Further, there are always costs associated with gathering and analyzing information. Net of information-acquisition costs and the return offered on a security should be commensurate with the security's level of risk. If superior returns can be earned after deducting information-acquisition costs, the market is relatively inefficient.

LOS 47d: Contrast weak-form, semi-strong form, and strong-form market efficiency. Vol 5, pp 124–129

Weak-Form Efficient Market Hypothesis

Weak-form EMH assumes that current stock prices reflect *all security market information*, including historical trends in prices, returns, volumes, and other market-generated

information such as block trades and trading by specialists. Under this hypothesis, because current stock market prices have essentially factored in all historical data, future returns on a stock should be independent of past returns or patterns.

Proponents of weak-form EMH assert that abnormal risk-adjusted returns cannot be earned by using trading rules and technical analysis, which make investing decisions based on historical security market data.

On the whole, various tests for weak-form EMH have backed the theory that current market prices reflect all available security market information and have led to the conclusion that the markets tend to be weak-form efficient. However, there is evidence that in countries with developing markets (e.g., China, Bangladesh, and Turkey) opportunities to profit from technical analysis do exist.

Abnormal returns are returns in excess of those implied by the SML for a stock with a given level of risk.

Semi-Strong Form Efficient Market Hypothesis

Semi-strong form EMH assumes that current security prices fully reflect *all security market information* and other public information. It encompasses weak-form EMH and also includes nonmarket public information such as dividend announcements, various financial ratios, and economic and political news in the set of information that is already factored into market values.

Proponents of the hypothesis assert that investors cannot earn abnormal risk-adjusted returns if their investment decisions are based on important material information after it has been made public. They stress that security prices rapidly adjust to reflect all public information.

Overall, semi-strong form EMH has received considerable support from studies in developed markets. In these markets, it has been found that abnormal risk-adjusted returns cannot be earned based on public information because security prices adjust for the information very quickly. However, there is some evidence that developing countries may not have semi-strong form efficient markets.

Strong-Form Efficient Market Hypothesis

Strong-form EMH contends that stock prices reflect *all public and private information.* It implies that no group of investors has sole access to any information that is relevant in price formation. Basically, there is no information out there that has not already been accounted for in current market prices.

Strong-form EMH encompasses weak-form and semi-strong form EMH and assumes perfect markets where information is cost free and available to all. Under strong-form EMH, no one can consistently achieve abnormal risk-adjusted returns, not even company insiders.

Studies have found that securities markets are not strong-form efficient. Abnormal risk-adjusted returns can be earned if material nonpublic information is used.

See Table 1-1 for a summary.

Table 1-1: Summary of Assertions of Various Forms of EMH

Form of EMH	Prices Fully Reflect	Types of Investors Who Cannot Earn Abnormal Returns Consistently
Weak form	All market (public) information.	Technical traders.
Semi-strong form	All market and nonmarket public information.	Technical traders and fundamental investors.
Strong form	All public and private information.	All investors.

Markets that are semi-strong form efficient must be weak-form efficient as well since public information includes market information. Similarly, markets that are strong-form efficient must also be semi-strong form efficient and weak-form efficient.

However, markets that are weak-form efficient may or may not be semi-strong form and strong-form efficient. Similarly, markets that are semi-strong form efficient may or may not be strong-form efficient.

LOS 47e: Explain the implications of each form of market efficiency for fundamental analysis, technical analysis, and the choice between active and passive portfolio management. Vol 5, pp 128–129

Implications of Efficient Market Hypothesis

- Securities markets are weak-form efficient. Therefore, past trends in prices cannot be used to earn superior risk-adjusted returns.
- Securities markets are also semi-strong form efficient. Therefore, investors who analyze information should consider what information is already factored into a security's price, and how any new information may affect its value.
- Securities markets are not strong-form efficient. This is because insider trading is illegal.

Efficient Markets and Technical Analysis

Technical analysts utilize charts to identify price patterns, which are used to make investment decisions. If the market is weak-form efficient, prices already reflect all available security market public information, and technical trading systems that depend only on past trading and price data cannot hold much value. Since tests have predominantly confirmed weak-form efficiency of markets, technical trading rules should not generate abnormal risk-adjusted profits after accounting for risks and transaction costs.

Efficient Markets and Fundamental Analysis

Fundamental analysts are concerned with the company that underlies the stock. They evaluate a company's past performance and examine its financial statements. They compute many performance ratios that aid them in assessing the validity of the stock's current price. They believe that a company's stock price can differ from its true intrinsic value, and investors who recognize the discrepancy can profit from it.

Fundamental analysis is necessary in a well-functioning securities market, as it helps market participants understand the implications of any new information. Further,

fundamental analysis can help generate abnormal risk-adjusted returns if an analyst is superior to her peers in valuing securities.

Efficient Markets and Portfolio Management

If markets are weak-form and semi-strong form efficient, active management is not likely to earn superior risk-adjusted returns on a consistent basis. Therefore, passive portfolio management would outperform active management. Studies have shown that on a risk-adjusted basis, mutual funds perform as well as the market before considering fees and expenses, but underperform the market after considering these costs.

The implication here is that the role of the portfolio manager is not necessarily to beat the market, but to manage the portfolio in light of the investor's risk and return objectives.

LESSON 2: MARKET PRICING ANOMALIES AND BEHAVIORAL FINANCE

LOS 47f: Describe market anomalies. Vol 5, pp 129–136

There is considerable evidence to suggest that markets are generally efficient. However, research has also highlighted a number of potential inefficiencies or anomalies that result in securities being mispriced. An anomaly occurs when a change in the price of an asset cannot be explained by the release of new information into the market.

- If markets are efficient, trading strategies designed to exploit market anomalies will not generate superior risk-adjusted returns on a consistent basis.
- An exception to the notion of market efficiency (an anomaly) would occur if a
- mispricing can be used to earn superior risk-adjusted returns consistently.

Observed anomalies can be placed into three categories.

1. Time-Series Anomalies

Calendar Anomalies

January effect: Studies have shown that since the 1980s, investors have earned significantly higher returns in the equity market during January compared to other months of the year. Tax reasons and "window-dressing" by portfolio managers have been held out as reasons to explain the January effect. However, recent evidence has suggested that the January effect is not persistent and does not produce superior returns on a risk-adjusted basis. Therefore, it is not a pricing anomaly. See Table 2-1 for other calendar anomalies.

Table 2-1: Other Calendar-Based Anomalies[1]

Anomaly	Observation
Turn-of-the-month effect	Returns tend to be higher on the last trading day of the month and the first three trading days of the next month.
Day-of-the-week effect	The average Monday return is negative and lower than the average returns for the other four days, which are all positive.
Weekend effect	Returns on weekends tend to be lower than returns on weekdays.
Holiday effect	Returns on stocks in the day prior to market holidays tend to be higher than other days.

1 Exhibit 4, Volume 5, CFA Program Curriculum 2017.

Momentum and Overreaction Anomalies

Certain short-term share price patterns arise as a result of investors overreacting to the release of new information. Investors tend to inflate stock prices of companies that have released good news and depress stock prices those that have released bad news. Studies have shown that "losers" (stocks that have witnessed a recent price decline due to the release of bad news) have outperformed the market in subsequent periods, while winners have underperformed in subsequent periods.

However, other studies have also shown that securities that have outperformed in the short term continue to generate high returns in subsequent periods (carrying on price momentum).

The overreaction and momentum anomalies go against the assertions of weak-form efficiency in markets.

2. Cross-Sectional Anomalies

Size Effect

Studies conducted in the past showed that shares of smaller companies outperformed shares of larger companies on a risk-adjusted basis. However, recent studies have failed to reach the same conclusion.

Value Effect

Studies have found that low P/E stocks have experienced higher risk-adjusted returns than high P/E stocks. These results go against semi-strong form market efficiency. However, when the Fama and French three-factor model is used instead of the CAPM to predict stock returns, the value stock anomaly disappears.

3. Other Anomalies

Closed-End Investment Fund Discounts

Several studies have shown that closed-end funds tend to trade at a discount (sometimes exceeding 50%) to their per-share NAVs. Theoretically, investors could purchase all the shares in the fund, liquidate the fund, and make a profit by selling the constituent securities at their market prices. However, after accounting for management fees, unrealized capital gains taxes, liquidity, and transaction costs, any profit potential is eliminated.

Earnings Surprises

Several studies have shown that although earnings surprises are quickly reflected in stock prices most of the time, this is not always the case. Investors may be able to earn abnormal returns using publicly available earnings information by purchasing stocks of companies that have announced positive earnings surprises. However, recent evidence has suggested that abnormal returns observed after earnings surprises do not control for transaction costs and risk.

Initial Public Offerings (IPOs)

Evidence suggests that investors who are able to acquire the shares of a company in an IPO at the offer price may be able to earn abnormal profits. However, this has not always

proven to be the case. Further, over the long run, performance of IPOs has generally been below average.

Predictability of Returns Based on Prior Information

Considerable research has suggested that equity returns are based on factors such as interest rates, inflation rates, stock volatility, and so on. However, the fact that equity returns are related to economic fundamentals is not evidence of market inefficiency.

Implications for Investment Strategies

Although there is some evidence to support the existence of valid anomalies, it is difficult to consistently earn abnormal returns by trading on them. On average, markets are efficient. Further, it is possible that identified anomalies may not be violations of market efficiency, but the result of the statistical methodologies used to detect them.

LOS 47g: Describe behavioral finance and its potential relevance to understanding market anomalies. Vol 5, pp 136–139

Behavioral Finance

Behavioral finance looks at investor behavior to explain why individuals make the decisions that they do, whether these decisions are rational or irrational. It is based on the premise that individuals do not always make "efficient" investment decisions, nor do they always act rationally due to the presence of **behavioral biases**. The existence of these biases has been offered as a possible explanation for a number of pricing anomalies.

Most asset-pricing models assume that markets are rational and that the intrinsic value of a security reflects this rationality. Note that market efficiency and asset-pricing models do not require that each individual is rational; instead the market overall must be rational. If certain individuals do not behave in a rational manner, other investors respond to this by executing trades that profit themselves, thereby moving the market toward efficiency.

Behavioral Biases

Loss Aversion

In most financial models, the assumption is that investors are **risk averse**; that is, investors dislike risk, and they require higher expected returns as compensation for exposure to additional risk. Behavioral finance asserts that investors exhibit **loss aversion** (i.e., they dislike losses more than they like comparable gains), which results in a strong preference for avoiding losses as opposed to achieving gains. Advocates of this bias argue that loss aversion is more important to investors than risk aversion, which is why the overreaction anomaly is observed. While loss aversion can explain the overreaction anomaly, studies have shown that underreactions are just as common as overreactions, which counters the assertions of this bias.

Herding

Herding is a behavioral bias that explains both underreactions and overreactions in financial markets. Herding occurs when investors ignore their own analysis, and instead make investment decisions in line with the direction of the market.

Overconfidence

Overconfidence bias asserts that investors have an inflated view of their ability to process new information appropriately. Overconfident investors are inaccurate when it comes to valuing securities given new information, and therefore stocks will be mispriced if an adequate number of such investors are in the market. Further, if mispricings are persistent and predictable, it may be possible for investors to earn abnormal profits.

Evidence has suggested that overconfidence has led to mispricing in most major markets around the world, but the bias has been observed predominantly in higher-growth companies, whose prices are slow to factor in any new information.

Another aspect of this bias is that overconfident investors tend to maintain portfolios that are less than optimally diversified because they tend to overestimate their stock-picking abilities.

Information Cascades

An information cascade is a concept that is similar but not identical to herding. Herding refers to clustered trading that may or may not be based on information. An information cascade refers to the transfer of information from market participants who are the first to take investment action upon the release of new information, and whose decisions influence the decisions of others. For example, earnings announcements are difficult to interpret without access to complete financial statements and "noisy" because it is uncertain what current earnings indicate regarding future profitability. In the immediate aftermath of the announcement, if the stock price moves in a particular direction, uninformed traders assume that trades conducted by more informed traders are the behind the change in stock price, and are therefore tempted to trade in the same direction themselves, creating an information cascade.

Information cascades can be rational. If informed traders act first and uninformed traders follow their lead, there will be an improvement in market efficiency as the cascade is helping the market correctly incorporate relevant information. Information cascades can also result in serial correlation in stock returns and to overreactions to information. Studies have shown that information cascades tend to be greater for stocks when reliable and relevant information about the underlying company is not easily available. They can actually improve the quality of information available to investors.

Other Behavioral Biases

- Representativeness, where investors assess probabilities of future outcomes as being similar to what they are in the current state.
- Mental accounting, where investors keep track of gains and losses from different investments in separate mental accounts.
- Conservatism, where investors are slow to react to changes, and continue to maintain their initial views.
- Narrow framing, where investors focus on issues in isolation.

All investors exhibit behavioral biases to different degrees. An understanding of these biases can help investors to recognize factors that affect their decision making, and, once they understand their own shortcomings, to make improved decisions going forward. The implications of behavioral finance on market efficiency are unclear. On one hand, if all investors must be rational for markets to be efficient, then the existence of behavioral biases suggests that markets cannot be efficient. On the other hand, if market efficiency means that investors cannot consistently earn superior risk-adjusted returns, then the evidence suggests that markets indeed tend to be efficient.

READING 48: OVERVIEW OF EQUITY SECURITIES

LESSON 1: OVERVIEW OF EQUITY SECURITIES

Equities in Global Financial Markets. Vol 5, pp 150–155

In order to evaluate the importance of equity securities in global financial markets, we must look at the total market capitalization and trading volumes of global equity markets and the prevalence of equity ownership across various geographic regions.

- In 2008, on a global level, the equity market capitalization to GDP ratio was close to 100% (more than twice the long run average of 50%). This shows that investors attach a significant value to publicly traded equities relative to the aggregate market value of goods and services produced globally every year (global GDP).
- Studies have shown that during 1900 to 2011, government bonds and bills earned annualized real returns of less than 2%, which is in line with the inflation rate. On the other hand, equity markets earned real returns in excess of 4% per year in most markets. Equity securities entail higher risk than government bonds and bills, but they earn higher returns to compensate for the higher risk. Note that equity securities also tend to be more volatile over time.
- In most developed countries, equity ownership as a percentage of the population was between 20% and 50%. This illustrates how heavily weighted equity securities are in most investor portfolios.

LOS 48a: Describe characteristics of types of equity securities. Vol 5, pp 155–161

LOS 48b: Describe differences in voting rights and other ownership characteristics among different equity classes. Vol 5, pp 155–161

A company may issue debt or equity securities to finance its operations. Issuing debt creates a liability for the company, as it is contractually obligated to make regular payments to its creditors. Investors who purchase debt securities are primarily interested in interest income.

On the other hand, issuing equity does not give rise to a liability. Shareholders have a residual claim on the company's assets after all liabilities have been paid. Investors who purchase equity securities are interested in capital appreciation as well as dividend income and therefore focus on the long-term performance of the company.

A company may issue the following types of equity securities:

Common Shares

Investors in common shares have an ownership interest in the company. They share the operating performance of the company, participate in the governance process through voting rights, and have a residual claim on the company's net assets in case of liquidation.

Voting rights enable common shareholders to have their say in major corporate decisions, including the election of the board of directors, and whether to merge with or acquire another company. In elections for the board of directors, companies may use statutory voting, where each share represents one vote, or cumulative voting, where total voting rights are based on the number of shares owned multiplied by the number of board directors being elected. Shareholders may apply all of their votes to a single candidate or spread them across the candidates in any proportion. Cumulative voting provides better representation of minority shareholders on the board.

Companies may issue different classes of common shares, each with different ownership and voting rights. Further, these different classes of shares might be entitled to different claims on the company's net assets in case of liquidation.

Common shares may also be callable or putable.

- **Callable** common shares give the issuing company the right, but not the obligation, to buy back shares from investors at a later date at the call price (which is specified when the shares are originally issued). Companies are likely to buy back shares when their market price is higher than the call price. This is beneficial for the company as it is able to:
  - Buy shares at a lower price and resell them at the higher market price.
  - Save on dividend payments and preserve its capital.

Callable common shares are also beneficial for the investors as they get a guaranteed return on their investments when the shares are called.

- **Putable** common shares give investors the right, but not the obligation, to sell their shares back to the issuing company at the put price (which is specified when the shares are originally issued). Investors are likely to exercise this right when the market price of shares is lower than the put price. Putable common shares limit investor losses. As far as the company is concerned, they make it easier to raise capital, as the put feature makes the shares more appealing to investors.

Preference Shares

Preference shares (also known as preferred stock) have the following characteristics:

- They do not give holders the right to participate in the operating performance of the company and they do not carry voting rights unless explicitly allowed for at issuance.
- They receive dividends before ordinary shareholders. Further, preferred dividends are fixed and are usually higher than dividends on common shares. However, the company is still not contractually obligated to make regular payments to holders of preferred stock.
- In case of liquidation, they have a higher priority in claims on the company's net assets than common shares. However, they still have a lower priority than bondholders.
- They can be perpetual (i.e., have no fixed maturity date), can pay dividends indefinitely, and can be callable or putable.

Preference shares can be classified into the following categories:

- **Cumulative:** Unpaid dividends on cumulative preference shares accrue over time and must be paid in full before dividends on common shares can be paid.
- **Noncumulative:** Unpaid dividends for one or more periods are forfeited permanently and are not accrued over time to be paid at a later date.
- **Participating:** These are entitled to preferred dividends plus additional dividends if the company's profits exceed a pre-specified level. Further, investors in participating preferred shares might be entitled to an additional distribution of the company's assets upon liquidation above the par value of the preference shares. Participating preference shares are more common in smaller, riskier companies in which investors are concerned about the company's possible future liquidation.
- **Nonparticipating:** These are only entitled to a fixed preferred dividend and the par value of shares in the event of liquidation.
- **Convertible:** These are convertible into a specified number of common shares based on a conversion ratio that is determined at issuance. They have the following advantages:
    - They allow investors to earn a higher dividend than if they had invested in the company's common shares.
    - They offer investors the opportunity to share the profits of the company.
    - They allow investors to benefit from a rise in the price of common shares through the conversion option.
    - Their price is less volatile than the underlying common shares because their dividend payments are known and more stable.

  Convertible preference shares are becoming increasingly common in venture capital and private equity transactions.

LOS 48c: Distinguish between public and private equity securities.
Vol 5, pp 162–164

Equity securities can also be issued and traded in private equity markets. Such securities are issued primarily to institutional investors via nonpublic offerings, such as private placements, and have the following characteristics:

- There is no active secondary market for them as they are not listed on public exchanges. Therefore, they do not have market-determined quoted prices.
- They are highly illiquid, and require negotiations between investors in order to be traded.
- The issuing companies are not required by regulatory authorities to publish financial statements and other important information regarding the company, which makes it difficult to determine fair values.

Types of Private Equity Investments

- **Venture capital:** Venture capital funds invest in companies that are still in the early stages of development and require additional capital for expansion. These investments are usually made through limited partnerships, where managing partners actively participate in the management of the investee. These investments require a horizon of several years, as the securities are not traded publicly. Eventual exit is a very important consideration in such investments and available exit routes include buyouts and initial public offerings (IPOs).

In cases where the group of investors acquiring the company is primarily comprised of the company's existing management, the transaction is referred to a **management buyout (MBO).**

- **Leveraged buyout (LBO):** An LBO occurs when a group of investors uses debt financing to purchase all of the outstanding common shares of a publicly traded company. The company is then taken "private" and its shares cease to be traded publicly. Typically, companies with undervalued assets and/or assets that can generate high levels of cash flow are subjects of LBOs. Companies that are bought out in this manner are usually restructured and later taken public again by issuing new shares to the public in the primary market.
- **Private investment in public equity:** Sometimes private investors may invest in a public company that is in need of additional capital quickly in return for a significant ownership position (typically at a discount to the publicly quoted market price). Companies may require funds quickly to avail significant investment opportunities or to deal with high levels of debt.

Advantages of Private Companies

- The longer investment horizons allow investors to focus on long-term value creation and to address any underlying operational issues facing the company. As a result, private equity firms are increasingly issuing convertible preference shares to attract investors with their greater total return potential. Publicly traded companies feel pressured to focus on short-term performance (e.g., to meet market expectations regarding earnings, growth, etc.).
- Certain costs that public companies must bear, such as those incurred to meet regulatory and stock exchange filing requirements, are avoided by private companies.

Advantages of Public Companies

- Public equity markets are much larger than private equity networks. Therefore, they provide more opportunities to companies for raising capital cheaply.
- Publicly traded companies are encouraged to be open about their policies, which ensures that they act in shareholder interest.

LOS 48d: Describe methods for investing in nondomestic equity securities.

Vol 5, pp 164–169

Technological advancements have led to the growth and integration of global capital markets. The ability to exchange information quickly through electronic networks has helped both companies and investors in the following ways:

- Companies are able to issue shares in international markets, making it easier and cheaper for them to raise capital and to expand their shareholder base beyond their local markets.
- Investors are able to invest in companies that are located abroad, which has enabled them to diversify their portfolios.

Studies have shown that reduced barriers to foreign ownership have led to improved equity market performance over the long term. As a result, more and more countries are becoming increasingly open to foreign investment. The following trends have emerged over the past two decades:

- An increasing number of companies have issued shares in markets outside of their home country.
- The number of companies whose shares are traded in markets outside of their home country has increased.
- An increasing number of companies are dual-listed (i.e., their shares are simultaneously issued and traded in two or more markets).

Listing a company on an international exchange has the following benefits:

- It improves awareness about the company's products and services.
- It enhances the liquidity of the company's shares.
- It increases corporate transparency due to the additional market exposure and the need to meet a greater number of filing requirements.

Methods for Investing in Nondomestic Equity Securities

Direct Investing

The most obvious way to invest in equity securities of foreign companies is to buy and sell securities directly in foreign markets. However, direct investing has the following implications:

- All transactions are in the company's, not the investor's domestic currency. Therefore, investors are also exposed to exchange rate risk.
- Investors must be familiar with the trading, clearing, and settlement regulations and procedures of the foreign market.
- Investing directly may lead to less transparency (due to the unavailability of audited financial statements on a regular basis) and increased volatility (due to limited liquidity).

Depository Receipts

A depository receipt (DR) is a security that trades like an ordinary share on a local exchange and represents an economic interest in a foreign company. It is created when a foreign company deposits its shares with a bank (the depository) in the country on whose exchange the shares will trade. The bank then issues a specific number of receipts representing the deposited shares based on a pre-determined ratio. Hence, one DR might represent one share, a number of shares, or a fractional share of the underlying stock.

The structure of the DR causes its price to be affected by the same factors that influence the price of the underlying shares, such as company fundamentals, market conditions, analysts' expectations, and so on. However, there might be short-term differences in the prices of the DR and the underlying stock giving rise to quick arbitrage opportunities.

A DR can be sponsored or unsponsored.

- A sponsored DR is when the foreign company that deposits its shares with the depository has a direct involvement in the issuance of receipts. Investors in sponsored DRs have the same rights as those enjoyed by direct owners of the company's common shares.
- In an unsponsored DR, the foreign company that deposits its shares with the depository has no involvement in the issuance of receipts. Therefore, it is the depository, not the investors, that enjoys rights as a direct owner of the company's common shares.

There are two types of depository receipts:

- *Global Depository Receipts (GDRs)*: GDRs are issued by the depository bank outside of the company's home country and outside of the United States. Their main advantage is that they are not subject to foreign ownership and capital flow restrictions that may be imposed by the issuing company's home country, as they are sold outside of the home country.
- *American Depository Receipts (ADRs)*: ADRs are denominated in U. S. dollars and trade like a common share on U. S. exchanges. They are basically GDRs that can be publicly traded in the United States. There are four primary types of ADRs, whose characteristics are listed in Table 1-1.

Table 1-1 Types of ADRs[1]

	Level I (Unlisted)	Level II (Listed)	Level III (Listed)	Rule 144A (Unlisted)
Objectives	Develop and broaden U.S. investor base with existing shares	Develop and broaden U.S. investor base with existing shares	Develop and broaden U.S. investor base with existing/ new shares	Access qualified institutional buyers (QIBs)
Raising capital on U.S. markets?	No	No	Yes, through public offerings	Yes, through private placements to QIBs
SEC registration	Form F-6	Form F-6	Forms F-1 and F-6	None
Trading	Over the counter (OTC)	NYSE, Nasdaq, or AMEX	NYSE, Nasdaq, or AMEX	Private offerings, resales, and trading through automated linkages such as PORTAL
Listing fees	Low	High	High	Low
Size and earnings requirements	None	Yes	Yes	None

1 - Exhibit 16, Volume 5, CFA Program Curriculum 2017.

Global Registered Shares (GRS)

A GRS is an ordinary share that is quoted and traded in different currencies on different stock exchanges around the world. GRSs offer more flexibility than DRs as the shares represent actual ownership in the issuing company, they can be traded anywhere, and currency conversions are not required to trade them.

Basket of Listed Depository Receipts (BLDR)

This is an exchange-traded fund (ETF) that represents a portfolio of DRs. Like all other ETFs, it trades throughout the day and can be bought, sold, or sold short just like an individual share. Further, it can be purchased on margin and used in hedging and arbitrage strategies.

LOS 48e: Compare the risk and return characteristics of different types of equity securities. Vol 5, pp 169–171

Return Characteristics of Equity Securities

The two main sources of an equity security's total return are:

1. Capital gains from price appreciation.
2. Dividend income.

Total Return, $R_t = (P_t - P_{t-1} + D_t) / P_{t-1}$

where:
P_{t-1} = Purchase price at time t – 1
P_t = Selling price at time t
D_t = Dividends paid by the company during the period

The total return on nondividend paying stocks only consists of capital gains. Companies that are in the early stages of their life cycle generally do not pay any dividends, as they try to reinvest their profits to avail growth opportunities. On the other hand, companies that are in the mature stage may not have as many profitable growth opportunities to avail, so they distribute profits to investors in the form of dividends or through share repurchases.

Investors in depository receipts and foreign shares also incur foreign exchange gains (or losses). These arise due to changes in the exchange rate between the investor's domestic currency and the foreign currency over the investment horizon. Appreciation of the foreign currency (depreciation of the domestic currency) leads to foreign exchange gains, while depreciation of the foreign currency (appreciation of the domestic currency) leads to foreign exchange losses.

Another source of return arises from the compounding effects of reinvested dividends. Reinvested dividends are cash dividends that an investor uses to purchase additional shares in the company. Studies have shown that the compounding effects of reinvested dividends have significantly influenced long-run returns on equity securities.

Risks of Equity Securities

The risk of an equity security refers to the uncertainty associated with its expected future cash flows or expected total return.

- Preference shares are less risky than common shares because:
  - Dividends on preference shares are known and fixed, reducing the uncertainty about future cash flows.
  - Preferred shareholders receive dividends and other distributions before common shareholders.
  - The amount that preference shareholders stand to receive if the company is liquidated is known and fixed as the par (or face) value of the shares. However, there is no guarantee that investors will receive this amount.
- Common shares are more risky because:
  - A relatively large proportion of their total return comes from capital gains and future dividends, which are unknown.
  - The amount that they receive if the company is liquidated depends on what is left over after all creditors and preferred shareholders have been paid off.
- Putable common shares are less risky than callable or noncallable common shares.
  - The option to sell the shares back to the issuer at a pre-determined price establishes the minimum expected return and reduces the uncertainty associated with future cash flows.
- Callable common and preference shares are more risky than their noncallable counterparts.
  - The option held by the issuer to buy back the shares at a pre-determined price limits the investors' potential total return.
- Cumulative preference shares are less risky than noncumulative preference shares as they accrue unpaid dividends.

LOS 48f: Explain the role of equity securities in the financing of a company's assets. Vol 5, pg 172

Equity Securities and Company Value

LOS 48g: Distinguish between the market value and book value of equity securities. Vol 5, pp 176–177

A company may issue equity securities to raise capital, to acquire another company, provide stock option-based incentives to employees, acquire long-lived assets, invest in expansion projects, enter new markets, improve capital adequacy ratios, or to ensure that debt covenants are met.

The primary aim of management is to increase the book value and market value of the company. Book value (shareholders' equity on the company's balance sheet) is calculated as total assets less total liabilities. It reflects the historical operating and financing decisions made by the company. Management can directly influence book value (e.g., by retaining net income).

However, management can only indirectly influence a company's market value as it is primarily determined by investors' expectations about the amount, timing, and uncertainty of the company's future cash flows. A company may increase its book value by retaining net income, but it will only have a positive effect on the company's market value if investors expect the company to invest its retained earnings in profitable growth opportunities. If investors believe that the company has a significant number of cash flow generating investment opportunities coming through, the market value of the company's equity will exceed its book value.

A useful ratio to evaluate investor's expectations about a company is the price-to-book ratio (also known as the market-to-book) ratio.

- If a company has a price-to-book ratio that is greater than industry average, it suggests that investors believe that the company has more significant future growth opportunities than its industry peers.
- It may not be appropriate to compare price-to-book ratios of companies in different industries because the ratio also reflects investors' growth outlook for the industry itself. Companies in high growth industries (e.g., technology) will have a higher average price-to-book ratio than companies in mature industries (e.g., manufacturing heavy equipment).

An important measure used by investors to evaluate the effectiveness of management in increasing the company's book value is accounting return on equity.

LOS 48h: Compare a company's cost of equity, its (accounting) return on equity, and investors' required rates of return. Vol 5, pp 172–178

Accounting Return on Equity

The accounting return on equity (ROE) measures the rate of return earned by a company on its equity capital. It indicates how efficient a firm is in generating profits from every dollar of net assets. The ROE is computed as net income available to ordinary shareholders (after preference dividends have been paid) divided by the average total book value of equity.

$$\text{ROE}_t = \frac{\text{NI}_t}{\text{Average BVE}_t} = \frac{\text{NI}_t}{(\text{BVE}_t + \text{BVE}_{t-1})/2}$$

In companies where book values are relatively stable, the beginning book value may be used in the denominator instead of the average book value. It is more appropriate to use average values for companies that experience more volatile year-end book values.

When using the ROE, analysts should bear in mind that net income and book value are directly affected by the management's choice of accounting methods (e.g., depreciation method and inventory cost flow assumption). These differences can make it difficult to compare the ROE across firms and to evaluate the ROE for the same firm over time (if accounting methods have changed).

An increase in ROE might not always be a positive sign for the company.

- The increase in ROE may be the result of net income decreasing at a slower rate than shareholders' equity. A declining net income is a source of concern for investors.
- The increase in ROE may be the result of debt issuance proceeds being used to repurchase shares. This would increase the company's financial leverage (risk).

Therefore, investors should examine the sources of change in ROE. This can be done through DuPont decomposition, which has been discussed in Reading 27.

Book values and ROE do help analysts evaluate companies, but they cannot be used as the primary means to determine a company's intrinsic value. Intrinsic value refers to the present value of the company's expected future cash flows, and can only be estimated as it is impossible to accurately predict the amount and timing of a company's future cash flows. Astute investors aim to profit from differences between market prices and intrinsic values.

The Cost of Equity and Investors' Required Rates of Return

A company may raise capital by issuing debt or equity, both of which have associated costs.

- A company's cost of debt is easy to estimate, as it is reflected in the interest payments that the company is contractually obligated to make to debt holders.
- Estimating cost of equity is difficult because the company is not contractually obligated to make any payments to common shareholders.

Investors' minimum required rates of return refer to the return they require for providing funds to the company.

- For investors who provide debt capital to the company, their minimum required rate of return is the periodic interest rate they charge the company for using their funds. Further, all providers of debt capital receive the same interest rate. Therefore, the company's cost of debt and investors' minimum required rate of return on debt are the same.
- For investors who provide equity capital to the company, the future cash flows that they expect to receive are uncertain (in both timing and amount), so their minimum required rate of return must be estimated. Further, each investor may have different expectations regarding future cash flows. Therefore, the company's cost of equity may be different from investors' minimum required rate of return on equity.

You should think about the cost of equity as the minimum expected rate of return that a company must offer investors to purchase its shares in the primary market and to maintain its share price in the secondary market. If the required rate of return is not maintained, the price of the security in the secondary market will adjust to reflect the minimum rate of return required by investors.

- If investors require a higher return than the company's cost of equity, they will sell the company's shares and invest elsewhere, which would bring down the company's stock price. This decline in the stock price will lead to an increase in the company's cost of equity and bring it in line with the (higher) required rate of return.

Please note:

- The company's cost of equity can be estimated using the dividend discount model (DDM) and capital asset pricing model (CAPM), which are discussed in other readings.
- The costs of debt and equity are used to estimate a company's weighted average cost of capital (WACC), which represents the minimum required rate of return that the company must earn on its average investment. This measure is frequently used in capital budgeting process and is discussed in Reading 35.

READING 49: INTRODUCTION TO INDUSTRY AND COMPANY ANALYSIS

LESSON 1: INTRODUCTION TO INDUSTRY AND COMPANY ANALYSIS

LOS 49a: Explain uses of industry analysis and the relation of industry analysis to company analysis. Vol 5, pp 188–189

Industry analysis has the following uses:

To understand a company's business and business environment. This is used in fundamental analysis, stock selection, and valuation as it provides insights into a company's growth opportunities, competitive dynamics, business risks, and credit risk.

To identify active equity investment opportunities. An analysis of industry fundamentals helps an analyst in forecasting the industry's growth and profitability. Analysts then decide the weights of different industries in their portfolios. Studies have shown that the industry factor is at least as important as the country factor in predicting stock returns. Industry analysis is also very important for industry and sector rotation strategies.

To attribute portfolio performance. Portfolio managers are evaluated on the relative performance of their sector and industry allocations. Industry classification plays an important role in performance attribution.

LOS 49b: Compare methods by which companies can be grouped, current industry classification systems, and classify a company, given a description of its activities and the classification system. Vol 5, pp 189–197

Industry classification divides companies into groups that have similar attributes. There are three major approaches to industry classification.

Products and/or Services Supplied

This classification scheme groups companies that make similar products and/or services. Companies are placed in industries based on their principal business activity (i.e., the source from which the company derives most of its revenues and/or earnings). Industries that are related to each other are grouped together to form a sector.

Business-Cycle Sensitivities

This approach groups companies based on their relative sensitivity to business cycles.

A cyclical company is one whose performance is positively correlated with the performance of the overall economy. Cyclical companies perform very well when the economy is booming, but perform relatively poorly during recessions. Cyclical companies typically have high operating leverage, which may be accompanied by high financial risk. Examples of cyclical industries include autos, industrials, and technology.

A non-cyclical company is one whose performance is relatively independent of the business cycle. Demand for products made by non-cyclical companies remains relatively stable. Examples of non-cyclical industries include health care and utilities.

LOS 49c: Explain the factors that affect the sensitivity of a company to the business cycle and the uses and limitations of industry and company descriptors such as "growth," "defensive," and "cyclical." Vol 5, pp 189–197

Analysts also often classify industries as defensive or growth industries. Defensive or stable industries are those whose profits are least affected by fluctuations in overall economic activity. Growth industries are industries whose specific demand dynamics override economic factors in determining their performance. These industries generate growth irrespective of overall economic conditions, though their growth rates may decline in recessions.

Limitations of these classifications

- The classification of companies as cyclical or non-cyclical is somewhat arbitrary. Economic downturns affect all companies, so cyclical and non-cyclical industries are better understood on a relative basis.
- At a given point in time, different countries and regions may be undergoing different stages of the business cycle. Comparing companies in the same industry that are currently operating in very different economic conditions may help identify investment opportunities, but establishing industry benchmark values with the data would be misleading.

Statistical Similarities

Statistical approaches group companies on the basis of correlations of historical returns. For example, cluster analysis separates companies into groups such that companies within a group have a high correlation of returns, but correlations between groups are low. This approach has the following limitations:

- The composition of industry groups may vary significantly over time and across geographical regions.
- There is no guarantee that past correlations will continue to hold going forward.
- A relationship may arise by chance.
- A relationship that is actually economically significant may be excluded.

Industry Classification Systems

Industry classification systems help analysts in studying industry trends and valuing companies. They enable analysts to make global comparisons of companies in the same industry.

Commercial Industry Classification Systems

Major index providers around the world classify companies in their equity indices into industry groupings. These systems have multiple levels of classification. They include:

- *Global Industry Classification Standard (GICS)*, which classifies industries according to their principal business activity.
- *Russell Global Sectors (RGS)*, which classifies industries on the basis of goods and/or services produced.
- *Industry Classification Benchmark (ICB)*, which groups companies on the basis of primary revenue sources.

Table 1-1 lists the types of companies in each representative sector.

Table 1-1: Description of Representative Sectors

Broad Industry Classifications	Includes
Basic materials and processing	Companies that produce building materials Companies that produce chemicals Companies that produce paper and forest products Companies that produce containers and packaging Metal, mineral, and mining companies
Consumer discretionary (Demand for products and services offered by these companies exhibits a relatively high level of economic sensitivity)	Automotive, apparel, hotel, and restaurant businesses
Consumer staples (Demand for products and services offered by these companies exhibits a relatively low level of economic sensitivity)	Manufacturers of food, beverage, tobacco, and personal care products
Energy	Energy exploration, refining, and production companies Companies that supply equipment to energy companies
Financial services	Banking companies Insurance companies Real estate companies Asset management companies Brokerage companies
Health care	Manufacturers of pharmaceutical and biotech products Manufacturers of medical devices Manufacturers of health care equipment Manufacturers of medical supplies Providers of health care services
Industrial/producer durables	Manufacturers of heavy machinery and equipment Aerospace and defense companies Transportation services Commercial services and supplies

(Table continued on next page…)

Table 1-1: *(continued)*

Broad Industry Classifications	Includes
Technology	Companies involved in the manufacture and sale of computers, software, semiconductors, and communications equipment Internet services Electronic entertainment Technology consulting
Telecommunications	Companies that provide fixed-line and wireless communication services
Utilities	Electric, gas, and water utilities Telecommunication companies are also sometimes included in this category

Governmental Industry Classification Systems

Various government agencies organize statistical data according to the type of industrial or economic activity to facilitate comparisons over time and across countries that use the same system. Governmental industry classification systems include:

- *International Standard Industrial Classification of All Economic Activities (ISIC)*, which classifies entities on the basis of their primary business activity. This system is currently being used by the UN and its specialized agencies, the International Monetary Fund, the World Bank, and other international bodies.
- *Statistical Classification of Economic Activities in the European Community (NACE)*, which uses a basis similar to that of ISIC.
- *Australian and New Zealand Standard Industrial Classification (ANZSIC)*
- *North American Industry Classification System (NAICS)*

Strengths and Weaknesses of Current Systems

Commercial classification systems generally have an advantage over government systems for the following reasons:

- Most government systems do not disclose information about specific businesses or companies, so an analyst does not have access to the constituents of a particular category.
- Commercial classification systems are reviewed and updated more frequently than government classification systems.
- Government classification systems do not distinguish between small and large businesses, between for-profit and not-for-profit organizations, or between public and private companies. Commercial classification systems make distinctions between small and large companies automatically by virtue of the companies' association with a particular equity index. Further, commercial classification systems only include for-profit and publicly traded organizations.

LOS 49d: Explain how a company's industry classification can be used to identify a potential "peer group" for equity valuation. Vol 5, pp 198–202

The narrowest classification group assigned to a company by current classification systems generally cannot be assumed to be its peer group. A **peer group** is a group of companies engaged in similar business activities whose economics and valuations are influenced by closely related factors. Comparing a company to a well-defined peer group is very useful in evaluating company performance and in relative valuation.

Commercial classification systems do provide a starting point in the construction of a peer group, as they provide a list of companies operating in the same industry. Analysts can then filter this list to come up with a set of companies whose businesses are truly comparable with that of the company being studied.

Steps in constructing a preliminary list of peer companies

- Examine commercial classification systems to identify companies operating in the same industry.
- Review the subject company's annual report to identify any mention of competitors.
- Review competitors' annual reports to identify other potential comparable companies.
- Review industry trade publications to identify comparable companies.
- Confirm that comparable companies have primary business activities that are similar to those of the subject company.

Steps in constructing a preliminary list of peer companies

- What proportion of revenue and operating profit is derived from business activities similar to those of the subject company? Generally speaking, a higher percentage results in a more meaningful comparison.
- Does a potential peer company face a demand environment similar to that of the subject company? A comparison of growth rates, margins, and valuations may be of limited value when comparing companies that are exposed to different stages of the business cycle.
- Does a potential company have a finance subsidiary? Some companies operate a finance division to facilitate the sale of their products. To make a meaningful comparison of companies, the analyst should make adjustments to the financial statements to eliminate the impact of finance subsidiaries on relevant financial ratios.

Companies with limited lines of business may easily be classified into a single peer group. However, companies with multiple divisions may be included in more than one category. Analysts should look to ensure that comparable companies have primary business activities and performance drivers similar to those of the subject company.

LOS 49e: Describe the elements that need to be covered in a thorough industry analysis. Vol 5, pp 202–203

Investment managers and analysts examine an industry's performance in relation to other industries to identify industries with superior returns. They also evaluate industries over time to determine how consistent and stable their returns are.

Figure 1-1: A Framework for Industry Analysis[1]

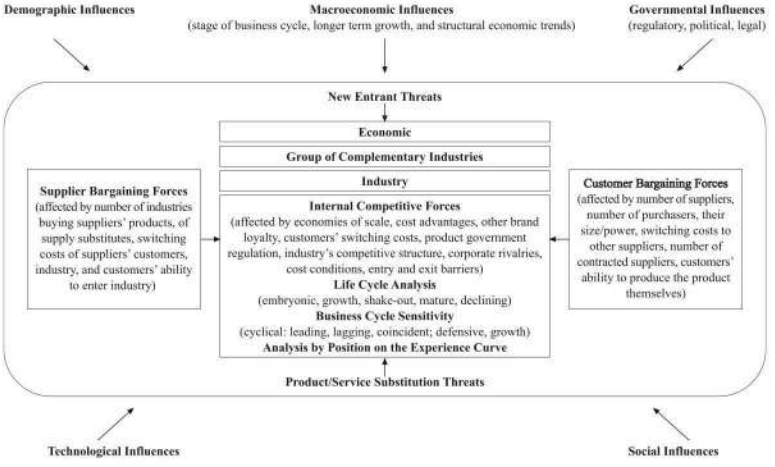


Figure 1-1 illustrates the macroeconomic, demographic, governmental, social, and technological factors that affect an industry at the macro level, and how an industry is affected by competitive forces, life-cycle issues, business-cycle considerations, and its position on the experience curve.

LOS 49f: Describe the principles of strategic analysis of an industry.

Vol 5, pp 204–206

When analyzing an industry, analysts need to understand the environment in which a company operates. Analysis of the industry with a view to examining the implications of the industrial environment on corporate strategy is known as **strategic analysis**.

Porter's Five Forces Framework

The starting point of strategic analysis is Michael Porter's "five forces" framework, which describes the following determinants of the intensity of competition in an industry.

1. Threat of substitute products: If customers find products to substitute for those produced by the company, demand for the company's products will decline.
2. Bargaining power of customers: This refers to the leverage enjoyed by customers in their dealings with the company. If the company has a small number of customers, they can be tough negotiators when it comes to determining prices.
3. Bargaining power of suppliers: This refers to the leverage enjoyed by suppliers in their dealings with the company. Suppliers of scarce or limited parts often have significant pricing power.

1 - Exhibit 2, Volume 5, CFA Program Curriculum 2017.

4. Threat of new entrants: This depends on the strength of barriers to entry into an industry. Low barriers to entry imply a higher degree of competition within an industry.
5. Intensity of rivalry: This is dependent on the industry's competitive structure. Industries that exhibit the following characteristics experience relatively more intense rivalries:
    - There are many small competitors.
    - Fixed costs are relatively high.
    - The companies produce similar products.
    - There are high exit barriers.

Note that the last two forces merit further investigation because almost all companies have competitors and must be wary of new entrants to their industries. When studying these forces, analysts should bear in mind that:

- Higher/stronger barriers to entry reduce competition.
- Greater concentration (where a small number of firms control a large part of the market) implies lower competition, while market fragmentation (where a large number of firms each have a relatively small share in the market) implies higher competition.
- Unused capacity in an industry, especially over an extended period, results in intense price competition.
- Stable market shares for industry firms imply less competition.
- Greater price sensitivity in customer purchasing decisions results in greater competition.
- More mature industries tend to exhibit slower growth.

LOS 49g: Explain the effects of barriers to entry, industry concentration, industry capacity, and market share stability on pricing power and price competition. Vol 5, pp 206–213

Barriers to Entry

Generally speaking:

- Low barriers to entry mean that new competitors can easily enter the industry, which makes the industry highly competitive. Companies in relatively competitive industries typically have little pricing power.
- High barriers to entry mean that existing companies are able to enjoy economic profits for a long period of time. These companies have greater pricing power.

However, bear in mind that these characteristics of high and low barrier industries are not always observed. For instance, companies might have little pricing power in industries with high barriers to entry because of fierce competition among existing companies (e.g., autos and aircraft manufacturing). Further, it is important to note that:

- Barriers to entry should not be confused with barriers to success. Entering some industries may be easy, but that does not necessarily mean that new entrants will be successful.
- Barriers to entry can change over time.

Industry Concentration

Generally speaking:

- If an industry is relatively concentrated (i.e., a few large firms dominate the industry), there is less price competition. This is because:

  - It is relatively easy for a few firms to coordinate their activities.
  - Larger firms have more to lose from destructive price behavior.
  - The fortunes of large firms are more tied to those of the industry as a whole, so they are more likely to be wary of the long-run impact of a price war on industry economics.
- If an industry is relatively fragmented (i.e., there is a large number of small firms in the industry), there is relatively high price competition. This is because of the following reasons:
  - Firms are unable to monitor their competitors' actions, which makes coordination difficult.
  - Each firm has only a small share of the market, so a small market share gain (through aggressive pricing) can make a large difference to each firm.
  - Each firm is small relative to the overall market so it tends to think of itself individualistically, rather than as a member of a larger group.

Bear in mind that there are important exceptions to the rules just defined. For example, Boeing and Airbus dominate the aircraft manufacturing industry, but competition between the two remains fierce.

Industry Capacity

Generally speaking:

- Limited capacity gives companies more pricing power as demand exceeds supply.
- Excess capacity results in weak pricing power as excess supply chases demand.

In evaluating the future competitive environment in an industry, analysts should examine current capacity levels as well as how capacity levels are expected to change in the future. Further, it is important to keep in mind that:

- If new capacity is physical (e.g., manufacturing facilities), it will take longer for the new capacity to come on line, so tight supply conditions may linger for an extended period. Usually however, once physical capacity is added, supply may overshoot, outstrip demand, and result in weak pricing power for an extended period.
- If new capacity requires financial and human capital, companies can respond to tight supply conditions fairly quickly.

Market Share Stability

Generally speaking:

- Stable market shares indicate less competitive industries.
- Unstable market shares often indicate highly competitive industries with little pricing power.

Market shares are affected by the following factors:

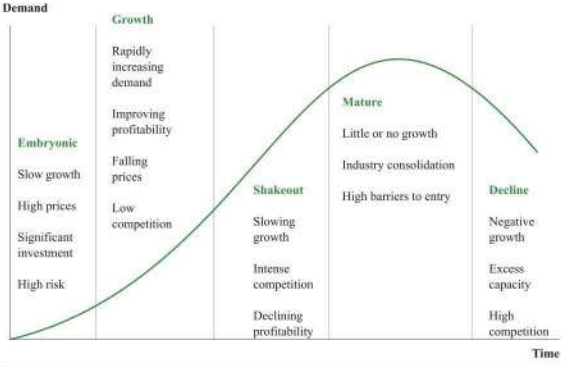
- Barriers to entry: Other things remaining the same, high barriers to entry prevent new firms from entering the industry, resulting in stable market shares of existing companies.
- New products: Other things remaining the same, frequent introductions of new products in the market lead to significant variation in market shares of existing firms. Market shares change quickly if switching costs are low and there is a relatively high benefit from switching.

- Product differentiation: Other things remaining the same, firms that are able to effectively differentiate their products from those of competitors are able to increase their share in the market.

LOS 49h: Describe industry life cycle models, classify an industry as to life cycle phase, and describe limitations of the life-cycle concept in forecasting industry performance. Vol 5, pp 213–218

Industry life-cycle analysis is an important part of strategic analysis of an industry. The sequential stages that an industry goes through are illustrated in Figure 1-2.

Figure 1-2: An Industry Life-Cycle Model[2]



The different stages in an industry's life cycle are:

Embryonic: Industries in this stage are just beginning to develop. They are characterized by:

- Slow growth as customers are still unfamiliar with the product.
- High prices as volumes are too low to achieve significant economies of scale.
- Significant initial investment.
- High risk of failure.

Companies focus on raising product awareness and developing distribution channels during this stage.

Growth: Once the new product starts gaining acceptance in the market, the industry experiences rapid growth. The growth stage is characterized by:

- New customers entering the market, which increases demand.
- Improved profitability as sales grow rapidly.
- Lower prices as economies of scale are achieved.

2 - Exhibit 6, Volume 5, CFA Program Curriculum 2017.

- Relatively low competition among companies in the industry as the overall market size is growing rapidly. Firms do not need to wrestle market share away from competitors to grow.
- High threat of new competitors entering the market due to low barriers to entry.

During this stage, companies focus on building customer loyalty and reinvest heavily in the business.

Shakeout: The period of rapid growth is followed by a period of slower growth. The shakeout stage is characterized by:

- Slower demand growth as fewer new customers are left to enter the industry.
- Intense competition as growth becomes dependent on market share growth.
- Excess industry capacity, which leads to price reductions and declining profitability.

During this stage, companies focus on reducing their costs and building brand loyalty. Some firms may fail or merge with others.

Mature: Eventually demand stops growing and the industry matures. Characteristics of this stage are:

- Little or no growth in demand as the market is completely saturated.
- Companies moving toward consolidation. They recognize that they are interdependent so they stay away from price wars. However, price wars may occur during downturns.
- High barriers to entry in the form of brand loyalty and relatively efficient cost structures.

During this stage, companies are likely to be pursuing replacement demand rather than new buyers and should focus on extending successful product lines rather than introducing revolutionary new products. Companies have limited opportunities to reinvest and often have strong cash flows. As a result, they are more likely to pay dividends.

Decline: Technological substitution, social changes, or global competition may eventually cause an industry to decline. The decline stage is characterized by:

- Negative growth.
- Excess capacity due to diminishing demand.
- Price competition due to excess capacity.
- Weaker firms leaving the industry.

Limitations of Industry Life-Cycle Analysis

- The following factors may change the shape of the industry life cycle, cause some stages to be longer or shorter than expected, or even result in certain stages being skipped altogether.
    - Technological changes: An industry may go from growth to decline if a revolutionary product or distribution channel is introduced in the market.
    - Regulatory changes: Deregulation may suddenly increase competition in an industry.
    - Social changes: For example, the casual dining industry has prospered over the past few decades as a result of an increase in the number of dual-income families.
    - Demographics: For example, an aging population is likely to benefit the health care industry.

- Industry life-cycle analysis is most useful in analyzing industries during periods of relative stability. It is not as useful in analyzing industries experiencing rapid change.
- Not all companies in an industry display similar performance. For example, Nokia has consistently been able to earn above average returns in a fiercely competitive industry.

Price Competition

Generally speaking:

- Industries in which price is the most significant consideration in customers' purchase decisions tend to be highly competitive. A slight increase in price may cause customers to switch to substitute products if they are widely available.
- Price is not as important if companies in an industry are able to effectively differentiate their products in terms of quality and performance. Customers may not focus on price as much if product reliability is more important to them.

LOS 49i: Compare characteristics of representative industries from the various economic sectors. Vol 5, pp 219–221

For an industry comparison, see Table 1-2.

Table 1-2: Elements of a Strategic Analysis for Three Industries[3]

	Branded Pharmaceuticals	Oil Services	Confections/Candy
Major companies	Pfizer, Novartis, Merck, GlaxoSmithKline	Schlumberger, Baker Hughes, Halliburton	Cadbury, Hershey, Mars/ Wrigley, Nestle
Barriers to entry/success	*Very High*: Substantial financial and intellectual capital required to compete effectively. A potential new entrant would need to create a sizable R&D operation, a global distribution network, and large-scale manufacturing capacity.	*Medium*: Technological expertise is required, but high level of innovation allows niche companies to enter the industry and compete in specific areas.	*Very High*: Low finance or technological hurdles, but new players would lack the established brands that drive consumer purchase decisions.
Impact of industry capacity	*NA*: Pharmaceutical pricing is primarily determined by patent protection and regulatory issues, including government approval of drugs and of manufacturing facilities. Manufacturing capacity is of little importance.	*Medium/High*: Demand can fluctuate quickly depending on commodity prices, and industry players often find themselves with too few (or too many) employees on the payroll.	*NA*: Pricing is driven primarily by brand strength. Manufacturing capacity has little effect.

(*continued*)

3 - Exhibit 7, Volume 5, CFA Program Curriculum 2017.

Table 1-2: *(continued)*

	Branded Pharmaceuticals	Oil Services	Confections/Candy
Level of concentration	*Concentrated*: A small number of companies control the bulk of the global markets for the branded drugs. The recent mergers have increased level of concentration.	*Fragmented*: Although only a small number of companies provide a full range of services, many smaller players compete effectively in specific areas. Service arms of national oil companies may control significant market share in their own countries, and some product lines are concentrated in the mature U.S. market.	*Very Concentrated*: Top four companies have a large proportion of global market share. Recent mergers have increased level of concentration.
Industry stability	*Stable*: The branded pharmaceutical market is dominated by major companies and consolidation via mega mergers. Market shares shift quickly, however, as new drugs are approved and gain acceptance or lose patent protection.	*Unstable*: Market shares may shift frequently depending on technology offerings and demand levels.	*Very Stable*: Market shares change glacially.
Life cycle	*Mature*: Overall demand does not change greatly from year to year.	*Mature*: Demand does not fluctuate with energy prices, but normalized revenue growth is only mid-single digits.	*Very Mature*: Growth is driven by population trends and pricing.
Price competition	*Low/Medium*: In the United States, price is a minimal factor because of consumer and provider driven, deregulated health care system. Price is a larger part of the decision process in single payer systems, where efficacy hurdles are higher.	*High*: Price is a major factor in purchaser decisions. Some companies have modest pricing power because of a wide range of services or best-in-class technology, but primary consumers (major oil companies) can usually substitute with in-house services if prices are too high. Also innovation tends to diffuse quickly throughout the industry.	*Low*: A lack of private level competition keeps pricing stable among established players, and brand/familiarity plays a much larger role in consumer purchase decisions than price.

Table 1-2: *(continued)*

	Branded Pharmaceuticals	Oil Services	Confections/Candy
Demographic influences	*Positive*: Populations of developed markets are aging, which slightly increases demand.	*NA*	*NA*
Government and regulatory influences	*Very High*: All drugs must be approved for sale by national safety regulators. Patent regimes may differ among countries. Also, health care is heavily regulated in most countries.	*Medium:* Regulatory framework can affect energy demand at the margin. Also, government plays an important role in allocating exploration opportunities to E&P companies, which can indirectly affect the amount of work flowing down to service companies.	*Low:* Industry is not regulated, but childhood obesity concerns in developed markets are a low-level potential threat. Also, high-growth emerging markets may block entry of established players into their markets, possibly limiting growth.
Social influences	*NA*	*NA*	*NA*
Technological influences	*Medium/High*: Biologic (large molecule) drugs are pushing new therapeutic boundaries, and many large pharmaceutical companies have a relatively small presence in biotech.	*Medium/High*: Industry is reasonably innovative, and players must reinvest in R&D to remain competitive. Temporary competitive advantages are possible via commercialization of new processes or exploitation of new accumulated expertise.	*Very Low*: Innovation does not play a major role in the industry.
Growth vs. Defensive vs. Cyclical	*Defensive*: Demand for most health care services does not fluctuate with the economic cycle, but demand is not strong enough to be considered "growth."	*Cyclical*: Demand is highly variable and depends on oil prices, exploration budget, and the economic cycle.	*Defensive*: Demand for candy and gum is extremely stable.

Note: "NA" in this table stands for "not applicable."

LOS 49j: Describe macroeconomic, technological, demographic, governmental, and social influences on industry growth, profitability, and risk. Vol 5, pp 221–228

Macroeconomic Influences

An industry's prospects are affected by overall economic activity. Gross domestic product (GDP), interest rates, availability of credit, and inflation all have an impact on the company's revenues, costs, and profits.

Technological Influences

Advancements in technology lead to new products being developed, which may replace older products. Further, these developments can sometimes change the way other industries that use these products conduct their operations.

Demographic Influences

Demography (population size, age distribution, and gender distribution) has important influences on economic growth and on the types of goods and services consumed. For example, an aging population has a negative effect on the economy as the size of the workforce declines. However, the health care industry benefits in the form of a larger customer base.

Governmental Influences

Government regulations have an impact on all sectors of the economy. Governments might exert their influence on an industry directly through taxes or subsidies, or indirectly by establishing regulatory bodies to govern the actions of an industry.

Social Influences

These influences refer to changes in how people work, spend their money, enjoy their leisure time, and conduct other aspects of their lives. Tobacco consumption has been on the decline as a result of increased social awareness regarding the harmful effects of smoking, and the perception that smoking in public is socially incorrect.

LOS 49k: Describe the elements that should be covered in a thorough company analysis. Vol 5, pp 228–232

Company analysis includes an analysis of the company's financial position, products and/or services, and competitive strategy. Porter identified two main competitive strategies:

Cost Leadership

Companies pursuing this strategy strive to cut down their costs to become the lowest-cost producers in an industry so that they can gain market share by charging lower prices. Pricing may be defensive (to protect market positions when competition is low) or aggressive (to increase market share when competition is intense).

Product/Service Differentiation

Companies pursuing this strategy strive to differentiate their products from those of competitors in terms of quality, type, or means of distribution. These companies are then able to charge a premium price for their products. This strategy is successful only if the price premium is greater than the cost of differentiation and the source of differentiation appeals to customers and is sustainable over time.

Elements That Should Be Considered in a Company Analysis

A thorough company analysis should:

- Provide an overview of the company.
- Explain relevant industry characteristics.
- Analyze the demand for the company's products and services.
- Analyze the supply of products and services, including an analysis of costs.
- Explain the company's pricing environment.
- Present and interpret relevant financial ratios, including comparisons over time and comparisons with competitors. See Exhibit 1-1.

Exhibit 1-1: A Checklist for Company Analysis[4]

Corporate Profile

- Identity of company's major products and services, current position in industry, and history
- Composition of sales
- Product life-cycle stages/experience curve effects
- Research and development activities
- Past and planned capital expenditures
- Board structure, composition, electoral system, anti-takeover provisions, and other corporate governance issues
- Management strengths, weaknesses, compensation, turnover, and corporate culture
- Benefits, retirement plans, and their influence on shareholder value
- Labor relations
- Insider ownership levels and changes
- Legal actions and the company's state of preparedness
- Other special strengths or weaknesses

(continued)

4 - Exhibit 8, Volume 5, CFA Program Curriculum 2017.

Exhibit 1-1: *(continued)*

Industry Characteristics

- Stage in its life-cycle
- Business-cycle sensitivity or economic characteristics
- Typical product life-cycles in the industry (short and marked by technological obsolescence or long, such as pharmaceuticals protected by patents)
- Brand loyalty, customer switching costs, and intensity of competition
- Entry and exit barriers
- Industry supplier considerations (concentration of sources, ability to switch suppliers or enter supplier's business)
- Number of companies in the business and whether it is, as determined by market shares, fragmented or concentrated
- Opportunity to differentiate product/service and related product/service, price, cost, and quality advantages/disadvantages
- Technologies used
- Government regulations
- State and history of labor relations
- Other industry problems/opportunities

Analysis of Demand for Products/Services

- Sources of demand
- Product differentiation
- Past records, sensitivities, and correlations with social, demographic, economic, and other variables
- Outlook—short, medium, and long term, including new product and business opportunities

Analysis of Supply of Products/Services

- Sources (concentration, competition, and substitutes)
- Industry capacity outlook—short, medium, and long term
- Company's capacity and cost structure
- Import/export considerations
- Proprietary products or trademarks

Analysis of Pricing

- Past relationships among demand, supply, and prices
- Significance of raw materials and labor costs and the outlook for their cost and availability
- Outlook for selling prices, demand, and profitability based on current and anticipated future trends

Exhibit 1-1: *(continued)*

Financial Ratios and Measures
(In multi-year spreadsheets with historical and forecast data)

- Activity Ratios, measuring how efficiently a company performs such functions as the collection of receivables and inventory management:
  - Days of sales outstanding (DSO)
  - Days of inventory on hand (DOH)
  - Days of payables outstanding (DPO)
- Liquidity Ratios, measuring a company's ability to meet its short-term obligations:
  - Current ratio
  - Quick ratio
  - Cash ratio
  - Cash conversion cycle (DOH + DSO – DPO)
- Solvency Ratios, measuring a company's ability to meet its obligations (in the following, "net debt" is the amount of interestbearing liabilities after subtracting cash and cash equivalents):
  - Net debt to EBITDA (earnings before interest, taxes, depreciation, and amortization)
  - Net debt to capital
  - Debt to assets
  - Debt to capital (at book and market values)
  - Financial leverage ratios (Average total assets/Average total equity)
  - Cash flow to debt
  - Interest coverage ratio
  - Off-balance sheet liabilities and contingent liabilities
  - Non-arm's-length financial dealings
- Profitability Ratios, measuring a company's ability to generate profitable sales from its resources (assets):
  - Gross profit margin
  - Operating profit margin
  - Pretax profit margin
  - Net profit margin
  - Return on investment capital or ROIC (Net operating profits after tax/Average invested capital)
  - Return on assets or ROA (Net income/Average total assets)
  - Return on equity or ROE (Net income/Average total equity)

(continued)

Exhibit 1-1: *(continued)*

- Financial Statistics and Related Considerations, quantities, and facts about a company's finances that an analyst should understand:
  - Growth rate of net sales
  - Growth rate of profit
  - EBITDA
  - Net income
  - Operating cash flow
  - EPS
  - Operating cash flow per share
  - Operating cash flow in relation to maintenance and total capital expenditures
  - Expected rate of return on retained cash flow
  - Debt maturities and ability of company to refinance and/or repay debt
  - Dividend payout ratio (Common dividends/Net income available to common shareholders)
  - Off-balance-sheet liabilities and contingent liabilities
  - Non-arm's-length financial dealings

Spreadsheet Modeling

Spreadsheet modeling is an important tool available to analysts to evaluate the historical performance of companies and to forecast future performance. It is widely used to quantify the effects of changes in certain swing factors on the company's performance. However, such models can be quite complex and analysts should bear in mind that any conclusions drawn from the model are dependent on the assumptions that were made in developing it.

READING 50: EQUITY VALUATION: CONCEPTS AND BASIC TOOLS

LESSON 1: INTRODUCTION

LOS 50a: Evaluate whether a security, given its current market price and a value estimate, is overvalued, fairly valued, or undervalued by the market.

Vol 5, pp 244–246

The aim of equity analysis is to identify mispriced securities. Securities are mispriced or incorrectly priced by the market when their market prices are different from their intrinsic values. Intrinsic or fundamental value refers to a security's true value and is estimated by analysts using a variety of models/techniques.

- If the estimate for a security's intrinsic value is lower than the market price, the security is overvalued by market.
- If the estimate for a security's intrinsic value is greater than the market price, the security is undervalued by the market.
- If the estimate for a security's intrinsic value equals the market price, the security is fairly valued.

In practice however, the analysis is not so straightforward. There are several uncertainties regarding the intrinsic value estimate with respect to the appropriateness of the valuation method used and its underlying assumptions. The final conclusion also depends on the analyst's level of confidence in her estimate of intrinsic value. If she finds that her estimates of intrinsic value tend to fall short of market consensus and current market prices, she might want to revisit her valuation models and assumptions before acting on a conclusion of overvaluation.

LOS 50b: Describe major categories of equity valuation models.

Vol 5, pp 246–248

There are three major categories of equity valuation models:

- Present value models (also known as discounted cash flow models)
- Multiplier models
- Asset-based valuation models

Each of these categories is discussed in detail in the remaining LOS of this reading.

LESSON 2: PRESENT VALUE MODELS

LOS 50c: Explain the rationale for using present value models to value equity and describe the dividend discount and free-cash-flow-to-equity models. Vol 5, pp 248–251

LOS 50e: Calculate and interpret the intrinsic value of an equity security based on the Gordon (constant) growth dividend discount model or a two-stage dividend discount model, as appropriate. Vol 5, pp 254–258

LOS 50f: Identify characteristics of companies for which the constant growth or a multistage dividend discount model is appropriate. Vol 5, pp 258–262

LOS 50k: Explain advantages and disadvantages of each category of valuation model. Vol 5, pp 254–262

Investors save money (defer consumption) in return for future benefits. Similarly, they make investments because they expect a return over the investment horizon. The value of an investment, therefore must equal the present value of its expected future cash flows. The simplest present value model for equity valuation is the dividend discount model (DDM):

The **dividend discount model (DDM)** values a share of common stock as the present value of its expected future cash flows (dividends).

$$\text{Value} = \frac{D_1}{(1+k_e)^1} + \frac{D_2}{(1+k_e)^2} + \ldots + \frac{D_\infty}{(1+k_e)^\infty}$$

$$\text{Value} = \sum_{t=1}^{n} \frac{D_t}{(1+k_e)^t}$$

Important:

- When an investor sells a share of common stock, the value that the purchaser will pay equals the present value of the future stream of cash flows (i.e., the remaining dividend stream). Therefore, the value of the stock at any point in time is still determined by its expected future dividends. When this value is discounted to the present, we are back at the original dividend discount model.
- If a company pays no dividends currently, it does not mean that its stock will be worthless. There is an expectation that after a certain period of time the firm will start making dividend payments. Currently, the company is reinvesting all its earnings in its business with the expectation that its earnings and dividends will be larger and will grow faster in the future. If the company does not make positive earnings going forward, there will still be an expectation of a liquidating dividend. The amount of this dividend will be discounted at the required rate of return to compute the stock's current price.
- The required rate of return on equity (ke) is usually estimated using the capital asset pricing model (CAPM). Another approach for calculating the required return on equity simply adds a risk premium to the before-tax cost of debt of the company.

Examples of DDM in Valuing Common Stock

One-year holding period: If our holding period is just one year, the value that we will place on the stock today is the present value of the dividends that we will receive over the year plus the present value of the price that we expect to sell the stock for at the end of the holding period. See Example 2-1.

$$\text{Value} = \frac{\text{dividend to be received}}{(1+k_e)^1} + \frac{\text{year-end price}}{(1+k_e)^1}$$

Example 2-1: One Period DDM

An analyst gathered the following information about a company:

- Current dividend per share (D_0) of common stock = $4.00.
- Expected growth rate for the year (g) = 20%.
- Risk-free rate of return = 6%.
- Expected return on the market portfolio = 11%.
- Beta of the company's common stock = 1.2.

Given that the stock will sell for $15.40 at the end of the year and that it will make only one dividend payment over the holding period (at the end of the year), calculate the value of the company's common stock.

Solution

The next dividend is calculated by multiplying the current dividend by 1 plus the projected growth rate.

The assumption here is that the stock only pays a dividend at the end of the year.

$$\begin{aligned} D_1 &= D_0(1+g) \\ &= 4(1+0.2) \\ &= \$4.80 \end{aligned}$$

The required return on equity is estimated using the CAPM:

$$\begin{aligned} k_e &= R_F + \beta(R_M - R_F) \\ &= 0.06 + 1.2(0.11 - 0.06) \\ &= 12.0\% \end{aligned}$$

Finally, we compute the present value of the expected future dividend and the expected future selling price:

$$\begin{aligned} V &= \frac{\$4.80}{(1+0.12)} + \frac{\$15.40}{(1+0.12)} \\ &= \$4.29 + \$13.75 \\ &= \$18.04 \end{aligned}$$

The stock is worth $18.04 based on the analyst's expectations of dividend growth, beta, market risk premium, and future selling price. This may or may not be the price that the stock is currently trading at. If the price calculated by the analyst (intrinsic value) of the stock based on her assumptions is *greater* than the current market price, the analyst should *buy* the stock because she expects its return to be *higher* than the required return for the stock given its beta (systematic risk).

Multiple-Year Holding Period DDM

We apply the same discounting principles for valuing common stock over multiple holding periods. In order to estimate the intrinsic value of the stock, we first estimate the dividends that will be received every year that the stock is held and the price that the stock will sell for at the end of the holding period. Then we simply discount these expected cash flows at the cost of equity (required return). See Example 2-2.

$$V = \frac{D_1}{(1+k_e)^1} + \frac{D_2}{(1+k_e)^2} + \ldots + \frac{D_n + P_n}{(1+k_e)^n}$$

where:
P_n = Price at the end of n years.

If we assume that dividends are growing at a constant rate every year, then:

$$D_1 = D_0(1+g);\ D_2 = D_0(1+g)^2 \text{ and } D_n = D_0(1+g)^n$$

Example 2-2: DDM for Multiple Holding Periods

Assume that a stock currently pays a dividend of $1.00, has an expected growth rate of 6%, and a required rate of return of 14.1%. Calculate the value of stock today if we expect to sell it for $15.30 in 2 years.

Solution

$$PV(D_1) = \frac{\$1.06}{1.141} = \$0.93$$

$$PV(D_2) = \frac{\$1.06(1.06)}{(1.141)^2} = \$0.86$$

PV of expected dividends over the holding period = $0.93 + $0.86 = $1.79

PV of the expected future selling price at the end of holding period = $\frac{\$15.30}{(1.141)^2} = \$11.75$

Value of stock = $1.79 + $11.75 = $13.54

The value of the stock based on the investor's expectations equals $13.54.

Infinite Period DDM (Gordon Growth Model)

The infinite period dividend discount model assumes that a company will continue to pay dividends for an infinite number of periods. It also assumes that the dividend stream will grow at a constant rate (g_c) over the infinite period. In this case, the intrinsic value of the stock is calculated as:

$$PV_0 = \frac{D_0(1+g_c)^1}{(1+k_e)^1} + \frac{D_0(1+g_c)^2}{(1+k_e)^2} + \frac{D_0(1+g_c)^3}{(1+k_e)^3} + \ldots + \frac{D_0(1+g_c)^\infty}{(1+k_e)^\infty}$$

This equation simplifies to:

$$PV = \frac{D_0(1+g_c)^1}{(k_e-g_c)^1} = \frac{D_1}{k_e-g_c}$$

The long-term (constant) growth rate is usually calculated as:

$$g_c = RR \times ROE$$

RR is the firm's earnings retention rate, which equals 1 minus the dividend payout ratio.

The Gordon growth model is highly appropriate for valuing dividend-paying stocks that are relatively immune to the business cycle and are relatively mature (e.g., utilities). It is also useful for valuing companies that have historically been raising their dividend at a stable rate.

Applying the DDM is relatively difficult if the company is not currently paying out a dividend. A company may not pay out a dividend because:

- It has a lot of lucrative investment opportunities available and it wants to retain profits to reinvest them in the business.
- It does not have sufficient excess cash flow to pay out a dividend.

Even though the Gordon growth model can be used for valuing such companies, the forecasts used are generally quite uncertain. Therefore, analysts use one of the other valuation models to value such companies and may use the DDM model as a supplement. The DDM can be extended to numerous stages. See Example 2-3. For example:

- A three-stage DDM is used to value fairly young companies that are just entering the growth phase. Their development falls into three stages—growth (with very high growth rates), transition (with decent growth rates), and maturity (with a lower growth into perpetuity).
- A two-stage DDM can be used to value a company currently undergoing moderate growth, but whose growth rate is expected to improve (rise) to its long-term growth rate.

Example 2-3: Applying the Gordon Growth Model

An analyst obtained the following information regarding Global Transporters Inc.:

Current share price = $28
Recent dividend per share = $1.95
Earnings per share = $4.25
Return on equity = 25%
Required rate of return = 20%

1. Use the Gordon growth model to estimate Global's intrinsic value.
2. How much does the dividend growth assumption add to the intrinsic value estimate?
3. Based on the intrinsic value estimate, is the company's share undervalued, fairly valued, or overvalued?
4. Calculate the intrinsic value if the growth rate estimate is lowered to 12%.
5. Calculate the intrinsic value if the growth rate estimate is lowered to 12% and the required rate of return estimate is increased to 22%.

Solution

1. Dividend payout ratio = 1.95 / 4.25 = 45.88%

   Therefore, earnings retention rate = 100% – 45.88% = 54.12%

   Dividend growth rate = Retention rate × ROE = 0.5412 × 0.25 = 13.53%

   Intrinsic value = $\frac{1.95 \times (1 + 0.1353)}{(0.2 - 0.1353)} = \$34.21$

2. Effect of the dividend growth assumption = 34.21 – (1.95 / 0.2) = $24.46

3. Global's current market price ($28) is lower than its intrinsic value ($34.21). Therefore, its stock is undervalued.

4. Intrinsic value = $\frac{1.95 \times (1 + 0.12)}{(0.2 - 0.12)} = \$27.30$

5. Intrinsic value = $\frac{1.95 \times (1 + 0.12)}{(0.22 - 0.12)} = \$21.84$

If the growth rate were zero, the stock would be valued as a perpetuity and its intrinsic value would equal:

$1.95/0.2 = $9.75

The relation between k_e and g_c is critical:

- As the difference between k_e and g_c *increases,* the intrinsic value of the stock *falls*.
- As the difference *narrows,* the intrinsic value of the stock *rises*.
- Small changes in either k_e or g_c can cause *large* changes in the value of the stock.

For the infinite-period DDM model to work, the following assumptions must hold:

- Dividends grow at a rate, g_c, which is not expected to change.
- k_e must be greater than g_c; otherwise, the model breaks down because of the denominator being negative.

Notice that the DDM formula on the previous page can be rearranged to make the required return, k_e, the subject:

$$k_e = \frac{D_1}{PV_0} + g_c$$

This expression for the cost of equity tells us that the return on an equity investment has two components:

- The dividend yield (D_1/P_0).
- Growth over time (g_c).

Valuation of Common Stock with Temporary Supernormal Growth

Growth companies are firms that are able to earn returns on investment that are consistently above their required rates of return. In order to take advantage of such opportunities, these companies tend to retain a very high proportion of their earnings and reinvest them in the business. These high retention rates translate into high growth rates (recall that a firm's sustainable growth rate equals its retention rate times its ROE). The assumptions of the infinite-period DDM do not hold for these growth companies because:

- They do not have constant dividend growth rates. The growth rate of dividends can be impressively high, but only for a temporary period. Eventually, competition catches up with these firms and their growth rate slows down.
- During periods when they experience extremely high growth rates, their growth rate can exceed the cost of equity (k_e).

The correct valuation model to value such "supernormal growth" companies is the **multistage dividend discount model** that combines the multi-period and infinite-period dividend discount models.

$$\text{Value} = \frac{D_1}{(1+k_e)^1} + \frac{D_2}{(1+k_e)^2} + \ldots + \frac{D_n}{(1+k_e)^n} + \frac{P_n}{(1+k_e)^n}$$

where:

$$P_n = \frac{D_{n+1}}{k_e - g_c}$$

D_n = Last dividend of the supernormal growth period
D_{n+1} = First dividend of the constant growth period

The following steps must be followed to value stocks of companies that experience temporary supernormal growth:

- Estimate the amount and duration of dividends during the supernormal growth phase.
- Forecast the normal, constant growth rate in dividends (g_c) that will occur once the supernormal growth period ends.
- Project the first dividend after the commencement of normal growth.
- Calculate the price of the stock at the end of the supernormal growth period using the infinite-period DDM. The first dividend after commencement of normal growth will be the numerator.
- Determine the cost of equity, k_e.
- Calculate the present value of supernormal growth-period dividends and the terminal stock price (the stock price at the end of supernormal growth).

If a company has two or three stages of supernormal growth, we must calculate the dividend for each year during supernormal growth separately. Once the growth rate stabilizes below the required rate of return, we can compute the terminal value of the firm by using the constant growth DDM. This method should become clear after going through Example 2-4.

Example 2-4: Valuation with Temporary Supernormal Growth

A company is expected to experience dividend growth rate of 20% for the next 3 years, 15% for the subsequent 2 years, and a constant growth rate of 6% thereafter. The last dividend paid out by the company was $1.50 per share and its cost of equity is 12%. Calculate the value of the company's stock.

Solution

First we calculate the dividends for each year during the supernormal growth phase:

$$D_1 = D_0 (1+ g_1)^1 = (1.50)(1.20)^1 = \$1.80$$
$$D_2 = D_0 (1+ g_1)^2 = (1.50)(1.20)^2 = \$2.16$$
$$D_3 = D_0 (1+ g_1)^3 = (1.50)(1.20)^3 = \$2.59$$
$$D_4 = D_3 (1+ g_2)^1 = (2.59)(1.15)^1 = \$2.98$$
$$D_5 = D_3 (1+ g_2)^2 = (2.59)(1.15)^2 = \$3.43$$

After Year 5, growth falls to a constant rate of 6%. The dividend for the 6^{TH} year will be:

$$D_6 = 3.43(1.06) = \$3.63$$

We use D_6 to calculate the value of the stock as of the beginning of the constant, infinite-growth period (end of Year 5),

$$P_5 = \frac{D_6}{k_e - g_c} = \frac{\$3.63}{(0.12 - 0.06)} = \$60.56$$

This value (P_5) represents the present value of remaining (constant growth) dividends on the stock as of the end of Year 5. It is also called the terminal value of the stock.

Finally, we add the present values of the high growth-period dividends and the terminal value of the stock at end of Year 5 to determine the intrinsic value of the stock:

$$\text{Value} = \frac{1.80}{(1+0.12)} + \frac{2.16}{(1+0.12)^2} + \frac{2.59}{(1+0.12)^3} + \frac{2.98}{(1+0.12)^4} + \frac{3.43}{(1+0.12)^5} + \frac{60.56}{(1+0.12)^5}$$

$$\text{Value} = 1.61 + 1.72 + 1.84 + 1.89 + 1.95 + 34.36 = \$43.37$$

Another variant of the supernormal growth scenario is when a company does not pay out dividends in the high growth period because it chooses to reinvest all of its earnings in the business. The company then pays out a dividend at the beginning of the constant growth period, and maintains a stable dividend payout ratio thereafter. See Example 2-5.

Example 2-5: Delayed Dividend Payment

A firm is expected to have 3 years of extraordinary growth during which no dividends will be paid. Beginning in Year 4, earnings will stabilize and grow at sustainable 5% rate indefinitely, and the firm will pay out 45% of its earnings in dividends. Given that earnings in Year 4 (E_4) are expected to be \$3.45 and the required return on equity is 10%, calculate value of this stock today.

Solution

D_4 = (dividend payout ratio)(E_4) = (0.45)(3.45) = \$1.55

$$P_5 = \frac{D_6}{k_e - g_c} = \frac{\$3.63}{(0.12 - 0.06)} = \$60.56$$

The value of this stock today equals the present value of the terminal value (P_3), which equals \$23.32

The Free-Cash-Flow-to-Equity (FCFE) Model

Many analysts assert that a company's dividend-paying capacity should be reflected in its cash flow estimates instead of estimated future dividends. FCFE is a measure of dividend paying capacity and can also be used to value companies that currently do not make any dividend payments. FCFE can be calculated as:

$$\text{FCFE} = \text{CFO} - \text{FC Inv} + \text{Net borrowing}$$

Analysts may calculate the intrinsic value of the company's stock by discounting their projections of future FCFE at the required rate of return on equity.

$$V_0 = \sum_{t=1}^{\infty} \frac{\text{FCFE}_t}{(1 + k_e)^t}$$

LOS 50d: Calculate the intrinsic value of a noncallable, non-convertible preferred stock. Vol 5, pp 251–254

When preferred stock is noncallable, nonconvertible, has no maturity date, and pays dividends at a fixed rate, the value of the preferred stock can be calculated using the perpetuity formula:

$$V_0 = \frac{D_0}{r}$$

For a noncallable, nonconvertible preferred stock with maturity at time, n, the value of the stock can be calculated using the following formula:

$$V_0 = \sum_{t=1}^{n} \frac{D_t}{(1+r)^t} + \frac{F}{(1+r)^n}$$

where:
V_0 = value of preferred stock today (t = 0)
D_t = expected dividend in year t, assumed to be paid at the end of the year
r = required rate of return on the stock
F = par value of preferred stock

Preferred shares may also be callable or putable:

- A callable preferred stock grants the issuer the right to call the stock at some point prior to maturity at a price determined at inception. Such call options tend to reduce the value of the issue for investors, as they favor the issuer.
- A putable preferred stock grants the holder the right to sell the stock back to the issuer at some point prior to maturity at a price determined at inception. Put options increase the value of the issue for investors as they favor the holder. See Example 2-6.

Example 2-6: Preferred Share Valuation: Two Cases

Aramis International issued perpetual preferred shares with a par value of $20 and pays an annual dividend of $3.65. Given a required rate of return of 8%, answer the following questions:

1. Calculate the intrinsic value of the shares if they are noncallable and nonconvertible.
2. Calculate the intrinsic value of the shares if they are retracted at par value after 3 years.

Solution

1. Intrinsic value = Dividend / Required rate of return = 3.65 / 0.08 = $45.63
2. Retractable term preferred shares specify a retraction date, at which the preferred shareholders have the option to sell back the shares to the issuer at a predetermined price. The intrinsic value in such cases is calculated as follows:

   Intrinsic value = $[(3.65 / 1.08) + (3.65 / 1.08^2) + (3.65 / 1.08^3) + (20 / 1.08^3)]$
   = $25.28

LESSON 3: MULTIPLIER MODELS AND ASSET-BASED VALUATION

LOS 50g: Explain the rationale for using price multiples to value equity, how the price to earnings multiple relates to fundamentals, and the use of multiples based on comparables. Vol 5, pp 263–271

Price multiples are ratios that compare the price of a stock to some sort of value. Price multiples allow an analyst to evaluate the relative worth of a company's stock. Popular multiples used in relative valuation include price-to-earnings, price-to-sales, price-to-book, and price-to-cash-flow.

A common criticism of price multiples is that they do not consider the future in that their values are calculated from trailing or current values of the divisor. For example a company's price to earnings ratio may be calculated by dividing the current market price by the company's earnings per share (EPS) over the most recent four quarters. To counter this criticism, analysts make forecasts of fundamental values (e.g., earnings) into the future and use forward-looking or leading multiples. For example, the leading P/E ratio may be calculated as the current stock price divided by expected EPS over the next four quarters.

Multiples Based on Fundamentals

A price multiple may be related to fundamentals through a dividend discount model such as the Gordon growth model. The expressions developed in such an exercise are interpreted as the justified (or based on fundamental) values for a multiple. Let's use the Gordon growth model to derive an expression for the justified P/E multiple for a stock.

Gordon growth DDM:

$$P_0 = \frac{D_1}{r - g}$$

Divide both sides of the equation by next year's earnings forecast, E_1.

$$\frac{P_0}{E_1} = \frac{D_1 / E_1}{r - g}$$

D_1/E_1 is known as the dividend payout ratio. It equals the proportion of its earnings that a company pays out as dividends.

Analysis of justified forward P/Es:

- The P/E ratio is inversely related to the required rate of return.
- The P/E ratio is positively related to the growth rate.
- The P/E ratio appears to be positively related to the dividend payout ratio. However, this relationship may not always hold because a higher dividend payout ratio implies that the company's earnings retention ratio is lower. A lower earnings retention ratio translates into a lower growth rate. This is known as the "dividend displacement" of earnings.

Justified forward P/E estimates are very sensitive to small changes in the assumptions used to compute them. Since the growth rate is calculated as ROE times the retention ratio, any changes in the dividend payout ratio also has an impact on the growth rate. Analysts usually carry out sensitivity analysis to study the impact of different assumptions on the justified ratio. See Example 3-1.

Example 3-1: Justified P/Es

Assume that a stock has an expected payout ratio of 40% and a required return on equity of 10%. With an expected growth rate of dividends of 8%, calculate the stock's justified P/E multiple.

Solution

$$\frac{P_0}{E_1} = \frac{D_1 / E_1}{k_e - g_c} = \frac{0.40}{0.1 - 0.08} = 20$$

Multiples Based on Comparables

This method compares relative values estimated using multiples to determine whether an asset is undervalued, overvalued, or fairly valued. The benchmark multiple can be any of:

- A multiple of a closely matched individual stock.
- The average or median multiple of a peer group or the firm's industry.
- The average multiple derived from trend or time-series analysis.

Sometime analysts may face difficulties in finding a benchmark or "comparable" to evaluate a company's price multiple. For example, large companies have several different lines of business. Analysts should be careful to select only those companies that have similar size, product lines, and growth prospects to the company being valued as comparables.

LOS 50h: Calculate and interpret the following multiples: price to earnings, price to an estimate of operating cash flow, price to sales, and price to book value. Vol 5, pg 263

Price to Earnings Ratio

Advantages

- Earnings are key drivers of stock value.
- The ratio is simple to calculate and widely used in the industry.
- According to empirical research, differences in P/E ratios are significantly related to long-term stock returns.

Disadvantages

- Companies that make losses have negative EPS and P/Es. Negative P/E ratios are useless as far as relative valuation is concerned.
- Earnings of some companies are very volatile, which makes the task of determining a fundamental stock value very challenging.
- Management can use different accounting assumptions to prepare their financial statements. This reduces the comparability of P/E ratios across companies.

Price to Cash Flow

See Example 3-2.

Advantages

- Cash flows are less prone to management manipulation than earnings.
- Price to cash flow is more stable than the P/E ratio.
- Using the price to cash flow ratio gets around the problem related to differences in accounting methods used by companies.
- Differences in price to cash flow ratio over time are related to differences in long term average returns on stocks.

Disadvantages

- When "EPS plus noncash charges" is used as the definition for cash flow, noncash revenue and changes in working capital items are ignored.
- Free cash flow is more appropriate for valuing a company than cash flow. However FCFE has the following drawbacks:
  - For many businesses, it is more volatile than CF.
  - It is more frequently negative than CF.

$$\text{Price to cash flow ratio} = \frac{\text{Market price of share}}{\text{Cash flow per share}}$$

Example 3-2: Calculating P/CF

ABC Company reported net income of $2.3 million for the year 2008. It recorded noncash charges of $0.4 million for the year, and has 2 million shares outstanding. The market price of the company's stock is currently $40. Compute its price to cash flow ratio.

Solution

Cash flow = $2,300,000 + $400,000 = $2,700,000
Cash flow per share = $2,700,000 / 2,000,000 = $1.35
Price to cash flow = $40 / $1.35 = 29.63

Price to Sales

Advantages

- Sales are less prone to manipulation by management than earnings and book values.
- Sales are positive even when EPS is negative.
- The P/S ratio is usually more stable than the P/E ratio.
- Price to sales is considered an appropriate measure for valuing mature, cyclical, and loss-making companies.
- Studies have shown that differences in price to sales ratios are related to differences in long-term average returns on stocks.

Disadvantages

- Using sales reveals no information about the operating profitability of a company. Ultimately, a company derives its value from its ability to generate profits.
- Using the P/S ratio does not reflect the differences in cost structure and operating efficiency between companies.
- Revenue recognition practices may allow management to distort revenue figures.

$$\text{Price to sales ratio} = \frac{\text{Market price per share}}{\text{Net sales per share}}$$

$$\text{Price to sales ratio} = \frac{\text{Market value of equity}}{\text{Total net sales}}$$

Net sales are calculated as gross sales less returns, customer discounts, and any dealer commissions. See Example 3-3.

Example 3-3: Calculating P/S

Krivya Chemicals reported net sales of $4,650,000 for the year ended 2008. It currently has 225,000 shares outstanding and its stock price is $14.35. Calculate Krivya's P/S ratio.

Solution

Sales per share = $4,650,000/225,000 = $20.67
Price to sales ratio = $14.35 / $20.67 = 0.69.

Price to Book Value

See Example 3-4.

Advantages

- Book value usually remains positive even when the company reports negative earnings.
- Book value is typically more stable over time compared to reported earnings.
- For financial sector companies that have significant holdings of liquid assets, P/BV is more meaningful, as book values reflect recent market values.
- P/BV is useful in valuing a company that is expected to go out of business.
- Studies suggest that differences in P/BV ratios over time are related to differences in long term average returns on stocks.

Disadvantages

- Book values ignore nonphysical assets such as the quality of a company's human capital and brand image.
- P/BV can lead to misleading valuations if significantly different levels of assets are being used by the companies being studied.
- Accounting differences can impair the comparability of P/BV ratios across companies. In most cases, book values of assets are based on historical cost adjusted for accumulated depreciation. However, over time, inflation and changes in technology may result in significant differences between accounting book values and actual values of a company's assets.

$$P/BV = \frac{\text{Current market price of share}}{\text{Book value per share}}$$

$$P/BV = \frac{\text{Market value of common shareholders' equity}}{\text{Book value of common shareholders' equity}}$$

where:
Book value of common shareholders' equity =
(Total assets – Total liabilities)– Preferred stock

Example 3-4: Calculating P/BV

The following table contains the equity portion of ADF Company's balance sheet:

	December 2006
Common stock (issued 20,000 common shares)	$200,000
Preferred stock (issued 1,000 preferred shares)	$25,000
Additional paid in capital	$1,000
Retained earnings	$43,875
Total shareholders' equity	$269,875

The current market price of ADF stock is $14.35. Calculate its P/BV ratio.

Solution

Common shareholders' equity = Total shareholders' equity – Total value of equity claims that are senior to common stock

= $269,875 – $25,000 = $244,875

Book value per share = $244,875/20,000 = $12.24

P/B = $14.35/$12.24 = $1.17

LOS 50i: Describe enterprise value multiples and their use in estimating equity value. Vol 5, pp 271–274

Enterprise value (EV) is calculated as the market value of the company's common stock, plus the market value of outstanding preferred stock if any, plus the market value of debt, less cash and short term investments (cash equivalents). It can be thought of as the cost of taking over a company.

EBITDA refers to earnings before interest, tax, depreciation, and amortization.

The most widely used EV multiple is the EV/EBITDA multiple. EBITDA is used as a proxy for operating cash flow, as it excludes noncash depreciation and amortization expenses. However, it may include other noncash expenses and revenues. The company pays out interest, dividends and taxes from its EBITDA. Therefore, EBITDA measures a company's income before payments to any providers of capital are made.

- The EV/EBITDA multiple is often used when comparing two companies with different capital structures.
- Loss-making companies usually have a positive EBITDA, which allows analysts to use the EV/EBITDA multiple to value them. The P/E ratio is meaningless (negative) for a loss-making company, as its earnings are negative.

Enterprise value may be difficult to calculate for companies whose debt is not publicly traded. Analysts may then use market prices of similar debt issues that are publicly traded as a proxy for the market value of the company's debt. Using book value as a proxy of market value will only provide a rough estimate, as book values do not incorporate changes in market interest rates and changes in the company's risk (as perceived by the market). See Example 3-5.

Example 3-5: EV/Operating Income

An analyst gathered the following information regarding five companies operating in the same industry:

Company	Enterprise Value ($)	Operating Income ($)
A	12,486,354	501,460
B	34,270,688	652,775
C	1,776,018	–306,210
D	6,688,225	210,985
E	3,206,250	427,500

1. Based on the information given, calculate each company's EV/OI.
2. Which company is the most undervalued?

Solution

1. The following table shows the EV/OI for each company:

Company	Enterprise Value ($)	Operating Income ($)	EV/OI
A	12,486,354	501,460	24.9
B	34,270,688	652,775	52.5
C	1,776,018	−306,210	−5.8
D	6,688,225	210,985	31.7
E	3,206,250	427,500	7.5

2. Company E has the lowest positive EV/OI ratio and therefore is the most undervalued or favorably priced stock. Note the negative EV/OI ratio of Company C. Negative EV/OI ratios are difficult to interpret and so the analyst must use some other means to evaluate such companies.

LOS 50j: Describe asset-based valuation models and their use in estimating equity value. Vol 5, pp 274–278

Asset-based valuation uses market values of a company's assets and liabilities to determine the value of the company as a whole.

Asset-based valuation works well for:

- Companies that do not have a significant number of intangible or "off-the-book" assets, and have a higher proportion of current assets and liabilities.
- Private companies, especially if applied together with multiplier models.
- Financial companies, natural resource companies, and companies that are being liquidated.

Asset-based valuation may not be appropriate when:

- Market values of assets and liabilities cannot be easily determined.
- The company has a significant amount of intangible assets.
- Asset values are difficult to determine (e.g., n periods of very high inflation).
- Market values of assets and liabilities significantly differ from their carrying values.