2023 CFA®
Exam Prep

Schweser's Secret Sauce®

LEVEL I

KAPLAN SCHWESER

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Level I CFA

2023

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SCHWESER'S SECRET SAUCE®: 2023 LEVEL I CFA®

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CONTENTS

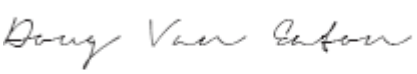
FOREWORD

This book will be a valuable addition to the study tools of any CFA exam candidate. It offers a very concise and very readable explanation of the major parts of the Level I CFA curriculum. Here is the disclaimer: this book does not cover every Learning Outcome Statement (LOS) and, as you are aware, any LOS is "fair game" for the exam. We have tried to include those LOS that are key concepts in finance and accounting, have application to other LOS, are complex and difficult for candidates, require memorization of characteristics or relationships, or are a prelude to LOS at Levels II and III.

We suggest you use this book as a companion to your other, more comprehensive study materials. It is easier to carry with you and will allow you to study these key concepts, definitions, and techniques over and over, which is an important part of mastering the material. When you get to topics where the coverage here appears too brief or raises questions in your mind, this is your clue to go back to your SchweserNotes™ or the textbooks to fill in the gaps in your understanding. For the great majority of you, there is no shortcut to learning the very broad array of subjects covered by the Level I curriculum, but this volume should be a very valuable tool for learning and reviewing the material as you progress in your studies over the months leading up to exam day.

Pass rates for most Level I exams in recent years have been 45% or less, and returning candidates make comments such as, "I was surprised at how difficult the exam was." You should not despair because of this, but you should definitely not underestimate the task at hand. Our study materials, mock exams, question bank, videos, seminars, and Secret Sauce are all designed to help you study as efficiently as possible, help you to grasp and retain the material, and apply it with confidence come exam day.

Best regards,



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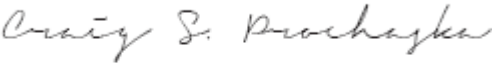

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QUANTITATIVE METHODS

Weight on Exam	8% to 12%
SchweserNotes™ Reference	Book 1, Pages 1–218

THE TIME VALUE OF MONEY

Understanding time value of money (TVM) computations is essential for success not only for quantitative methods, but also other sections of the Level I exam. TVM is actually a larger portion of the exam than simply quantitative methods because of its integration with other topics. For example, any portion of the exam that requires discounting cash flows will require TVM calculations. This includes evaluating capital projects, using dividend discount models for stock valuation, valuing bonds, and valuing real estate investments. No matter where TVM shows up on the exam, the key to any TVM problem is to draw a timeline and be certain of when the cash flows will occur so you can discount those cash flows appropriately.

An interest rate can be interpreted as a required rate of return, a discount rate, or as an opportunity cost; but it is essentially the price (time value) of money for one period. When viewed as a required (equilibrium) rate of return on an investment, a nominal interest rate consists of a real risk-free rate, a premium for expected inflation, and other premiums for sources of risk specific to the investment, such as uncertainty about amounts and timing of future cash flows from the investment.

Interest rates are often stated as simple annual rates, even when compounding periods are shorter than one year. With *m* compounding periods per year and a stated annual rate of *i*, the effective annual rate is calculated by compounding the periodic rate (i/m) over *m* periods (the number of periods in one year).

$$\text{effective annual rate} = \left(1 + \frac{i}{m}\right)^{m} - 1$$

With a stated annual rate of 12% (0.12) and monthly compounding, the effective rate $= \left(1 + \frac{0.12}{12}\right)^{12} - 1 = 12.68\%.$

Future value (FV) is the amount to which an investment grows after one or more compounding periods.

- *Compounding* is the process used to determine the future value of a current amount.
- The *periodic rate* is the nominal rate (stated in annual terms) divided by the number of compounding periods (i.e., for quarterly compounding, divide the annual rate by four).
- The *number of compounding periods* is equal to the number of years multiplied by the frequency of compounding (i.e., for quarterly compounding, multiply the number of years by four).

$$\text{future value} = \text{present value} \times (1 + \text{periodic rate})^{\text{number of compounding periods}}$$

Present value (PV) is the current value of some future cash flow.

- *Discounting* is the process used to determine the present value of some future amount.
- *Discount rate* is the periodic rate used in the discounting process.

$$\text{present value} = \frac{\text{future value}}{(1 + \text{periodic rate})^{\text{number of compounding periods}}}$$

For *non-annual compounding* problems, divide the interest rate by the number of compounding periods per year, *m*, and multiply the number of years by the number of compounding periods per year.

An *annuity* is a stream of equal cash flows that occur at equal intervals over a given period. A corporate bond combines an annuity (the equal semiannual coupon payments) with a lump sum payment (return of principal at maturity).

- *Ordinary annuity*. Cash flows occur at the end of each compounding period.
- *Annuity due*. Cash flows occur at the beginning of each period.

Present value of an ordinary annuity. Answers the question: How much would an annuity of $*X* every (month, week, quarter, year) cost today if the periodic rate is *I* %?

The present value of an annuity is just the sum of the present values of all the payments. Your calculator will do this for you.

- N = number of periods.
- I/Y = interest rate per period.
- PMT = amount of each periodic payment.
- FV = 0.
- Compute (CPT) present value (PV).

In other applications, any four of these variables can be entered in order to solve for the fifth. When both present and future values are entered, they typically must be given different signs in order to calculate N, I/Y, or PMT.

Future value of an ordinary annuity. Just change to PV = 0 and CPT → FV.

If there is a mismatch between the period of the payments and the period for the interest rate, adjust the interest rate to match. Do not add or divide payment amounts. If you have a *monthly payment*, you need a *monthly interest rate*.

Present and Future Value of an Annuity Due

When using the TI calculator in END mode, the PV of an annuity is computed as of t = 0 (one period prior to the first payment date, t = 1) and the FV of an annuity is calculated as of time = N (the date of the last payment). With the TI calculator in BGN mode, the PV of an annuity is calculated as of t = 0 (which is now the date of the first payment) and the FV of an annuity is calculated as of t = N (one period after the last payment). In BGN mode,

the N payments are assumed to come at the beginning of each of the N periods. An annuity that makes N payments at the beginning of each of N periods is referred to as an annuity due.

Once you have found the PV(FV) of an ordinary annuity, you can convert the discounted (compound) value to an annuity due value by multiplying by one plus the periodic rate. This effectively discounts (compounds) the ordinary annuity value by one less (more) period.

$$PV_{\text{annuity due}} = PV_{\text{ordinary annuity}} \times (1 + \text{periodic rate})$$
$$FV_{\text{annuity due}} = FV_{\text{ordinary annuity}} \times (1 + \text{periodic rate})$$

Perpetuities are annuities with infinite lives:

$$PV_{\text{perpetuity}} = \frac{\text{periodic payment}}{\text{periodic interest rate}}$$

Preferred stock is an example of a perpetuity (equal payments indefinitely).

Present (future) values of any series of cash flows is equal to the sum of the present (future) values of each cash flow. This means you can break up cash flows any way that is convenient, take the PV or FV of the pieces, and add them up to get the PV or FV of the whole series of cash flows.

ORGANIZING, VISUALIZING, AND DESCRIBING DATA

Numerical data are values that can be counted or measured. Mathematical operations can be performed on numerical data. Numerical data may be discrete or continuous. **Discrete data** are countable. **Continuous data** can take any fractional value (e.g., the annual percentage return on an investment), so a continuous variable has an infinite number of possible outcomes.

Categorical data consist of labels that can be used to classify a set of data into groups. Categorical data may be nominal or ordinal. **Nominal data** are labels that cannot be placed in order logically; **ordinal data** can be ranked in a logical order.

A **time series** is a set of observations taken periodically over time. **Cross-sectional data** refers to a set of comparable observations all taken at one specific point in time. Time series and cross-sectional data can be combined into **panel data**.

Time series, cross-sectional, and panel data are examples of **structured data**—they are organized in a defined way. **Unstructured data** refers to information presented in a form with no defined structure, such as text data.

A **one-dimensional array** shows values for a single variable. Panel data are an example of a **two-dimensional array**, or a **data table**.

Displaying Data

An absolute **frequency distribution** shows the number of observations in a data set for specified groups, or intervals. A relative frequency distribution shows the percentage of outcomes within categories or intervals.

A cumulative absolute frequency or cumulative relative frequency is the sum of the absolute or relative frequencies less than or equal to a given interval.

A **contingency table** is a two-dimensional array with rows that represent attributes of one of the variables and with columns that represent attributes of the other variable. The values in each cell are the frequencies with which we observe two attributes simultaneously, known as **joint frequencies**, which can be absolute or relative frequencies. The total of frequencies for a row or a column is termed the **marginal frequency** for that attribute.

One kind of contingency table is a 2-by-2 array called a **confusion matrix**, which displays the number of "yes" or "no" predictions and the number of each that were actually observed.

Typically the most effective chart types for various purposes are the following:

- *Relationships*. Scatter plots, scatter plot matrices, and heat maps.
- *Comparisons*. Bar charts, tree maps, and heat maps for comparisons among categories; line charts, dual-scale line charts, and bubble line charts for comparisons over time.
- *Distributions*. Histograms, frequency polygons, and cumulative distribution charts for numerical data; bar charts, tree maps, and heat maps for categorical data; and word clouds for text data.

Measures of Central Tendency

Arithmetic mean. A population average is called the population mean (denoted μ).

The average of a sample (subset of a population) is called the sample mean (denoted $\bar{x}$). Both the population and sample means are calculated as arithmetic means (simple average). We use the sample mean as a "best guess" approximation of the population mean.

Median. Middle value of a data set, half above and half below. With an even number of observations, median is the average of the two middle observations.

Mode. Value occurring most frequently in a data set. Data set can have more than one mode (bimodal, trimodal, etc.) but only one mean and one median.

Geometric mean:

- Used to calculate compound growth rates.
- If returns are constant over time, geometric mean equals arithmetic mean.
- The greater the variability of returns over time, the greater the difference between arithmetic and geometric mean (arithmetic will always be higher).
- When calculating the geometric mean for a returns series, it is necessary to add one to each value under the radical, and then subtract one from the result.
- The geometric mean is used to calculate the time-weighted return, a performance measure.

$$\text{geometric mean return} = R_G = \sqrt[n]{(1+R_1)\times(1+R_2)\times\ldots\times(1+R_n)} - 1$$

EXAMPLE

A mutual fund had the following returns for the past three years: 15%, –9%, and 13%. What is the arithmetic mean return, the 3-year holding period return, and the average annual compound (geometric mean) return?

Answer:

$$\text{arithmetic mean: } \frac{15\% - 9\% + 13\%}{3} = 6.333\%$$

$$\text{holding period return: } 1.15 \times 0.91 \times 1.13 - 1 = 0.183 = 18.3\%$$

$$\text{geometric mean: } R_G = \sqrt[3]{(1+0.15)\times(1-0.09)\times(1+0.13)} - 1$$

$$= \sqrt[3]{1.183} - 1 = 1.0575 - 1 = 0.0575 = 5.75\%$$

Geometric mean return is useful for finding the yield on a zero-coupon bond with a maturity of several years or for finding the average annual growth rate of a company's dividend or earnings across several years. Geometric mean returns are a compound return measure.

Unusually large or small values, or **outliers**, can have a disproportionate influence on the arithmetic mean. Two measures that remove the influence of outliers on the means are as follows:

- A **trimmed mean**, which excludes a stated percentage of the most extreme observations. A 1% trimmed mean, for example, would discard the lowest 0.5% and the highest 0.5% of the observations.
- A **winsorized mean** in which, instead of discarding the highest and lowest observations, we substitute a value for them. To calculate a 90% winsorized mean, for example, we would determine the 5th and 95th percentile of the observations, substitute the 5th percentile for any values lower than that, substitute the 95th percentile for any values higher than that, and then calculate the mean of the revised data set.

Quantile is the general term for a value at or below which a stated proportion of the data in a distribution lies. Examples of quantiles include the following:

- **Quartile.** The distribution is divided into quarters.
- **Quintile.** The distribution is divided into fifths.
- **Decile.** The distribution is divided into tenths.
- **Percentile.** The distribution is divided into hundredths (percentages).

Note that any quantile (e.g., third quartile) may be expressed as a percentile (e.g., 75th).

The difference between the third quartile and the first quartile (25th percentile) is known as the **interquartile range**.

The formula for the position of the observation at a given percentile, *y*, with *n* data points sorted in ascending order is as follows:

$$L_y = (n+1)\frac{y}{100}$$

In a **box and whisker plot**, the box represents the central portion of the data, such as the interquartile range. The vertical line represents the entire range, and the median or mean can be shown along this line.

Quantiles and measures of central tendency are known collectively as **measures of location**.

Appropriate uses for the various definitions of the mean are as follows:

- *Arithmetic mean.* Estimate the next observation or the expected value of a distribution.
- *Geometric mean.* Calculate compound rates of return over multiple periods.
- *Trimmed mean*. Estimate the mean without the effects of a given percentage of outliers.
- *Winsorized mean.* Decrease the effect of outliers on the mean.
- *Harmonic mean.* Calculate the average share cost from periodic purchases in a fixed dollar amount.

Measures of Dispersion

Range is the difference between the largest and smallest value in a data set and is the simplest measure of dispersion. You can think of the dispersion as measuring the width of the distribution. The narrower the range, the less dispersion.

For a population, *variance* is defined as the average of the squared deviations from the mean.

EXAMPLE

Stocks A, B, and C had returns of 10%, 30%, and 20%, respectively. Calculate the sample variance (denoted s^2).

Answer:

Step 1: $\frac{(10+30+20)}{3} = 20$

Step 2: Calculate the squared deviations from the mean and add them together:

$(10-20)^2 + (30-20)^2 + (20-20)^2 = 100 + 100 + 0 = 200$

Step 3: Divide by number of observations minus one:

$$\text{sample variance} = s^2 = \frac{200}{3-1} = \frac{200}{2} = 100$$

Standard deviation is the square root of variance. On the exam, if the question is asking for the standard deviation, do not forget to take the square root!

Coefficient of variation expresses how much dispersion exists relative to the mean of a distribution and allows for direct comparison of the degree of dispersion across different data sets. It measures risk per unit of expected return.

$$\text{CV} = \frac{\text{standard deviation of returns}}{\text{mean return}}$$

When comparing two investments using the CV criterion, the one with the lower CV is the better choice.

Sometimes, measures of dispersion that focus only on downside risk are appropriate. One measure of downside risk is **target downside deviation**, which is also known as **target semideviation**. Calculating target downside deviation is similar to calculating standard deviation, but in this case, we choose a target value against which to measure each outcome and only include deviations from the target value in our calculation if the outcomes are below that target.

The formula for target downside deviation is stated as follows:

$$s_{\text{target}} = \sum_{\text{all } X_i < B}^{n} \sqrt{\frac{(X_i - B)^2}{n-1}}, \text{ where B is the target return}$$

Note that the denominator remains the sample size *n* minus one, even though we are not using all the observations in the numerator.

Skewness and Kurtosis

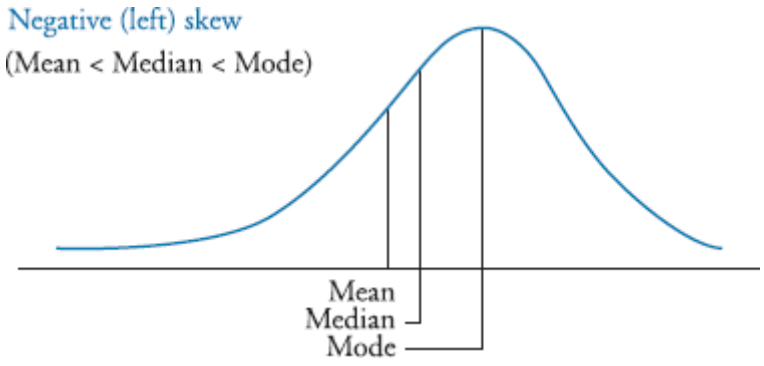
Skewness represents the extent to which a distribution is not symmetrical.

A *right-skewed* distribution has positive skew (or skewness) and a mean that is greater than the median, which is greater than the mode.

A *left-skewed* distribution has negative skewness and a mean that is less than the median, which is less than the mode.

A negatively skewed distribution is illustrated in the following figure.

Figure 1: Negatively Skewed Distribution

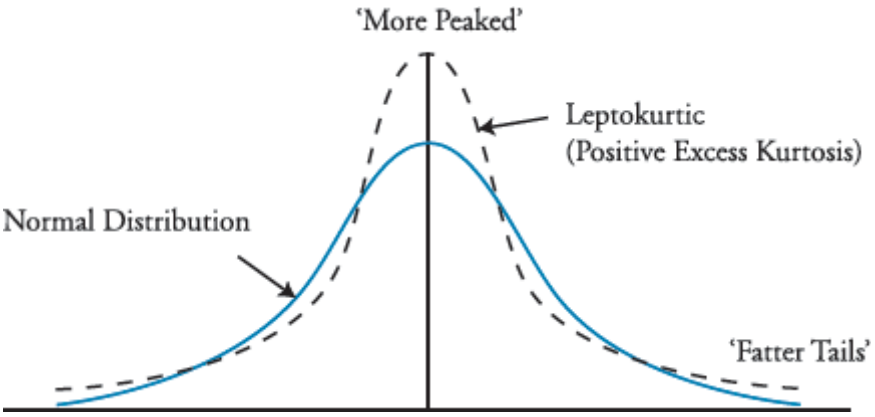


Kurtosis is a measure of the degree to which a distribution is more or less peaked than a normal distribution, which has kurtosis of 3.

Excess kurtosis is kurtosis relative to that of a normal distribution. A distribution with kurtosis of 4 has excess kurtosis of 1. It is said to have positive excess kurtosis. A distribution with positive excess kurtosis (a leptokurtic distribution) will have more returns clustered around the mean and more returns with large deviations from the mean (fatter tails). In finance, positive excess kurtosis is a significant issue in risk assessment and management, because fatter tails means an increased probability of extreme outcomes, which translates into greater risk.

An illustration of the shapes of normal and leptokurtic distribution is given in the following graph.

Figure 2: Kurtosis



PROBABILITY CONCEPTS

The ability to apply probability rules is important for the exam. Be able to calculate and interpret widely used measures such as expected value, standard deviation, covariance, and correlation.

Important Terms

- *Random variable*. Uncertain quantity/number.
- *Outcome*. Realization of a random variable.
- *Event*. Single outcome or a set of outcomes.
- *Mutually exclusive events*. Cannot both happen at same time.
- *Exhaustive set of events*. Set that includes all possible outcomes.

The probability of any single outcome or event must not be less than zero (will not occur) and must not be greater than one (will occur with certainty). A *probability function* (for a discrete probability distribution) defines the probabilities that each outcome will occur. To have a valid probability function, it must be the case that the sum of the probabilities of any set of outcomes or events that is both mutually exclusive and exhaustive is 1 (it is certain that a random variable will take on one of its possible values). An example of a valid probability function is:

> Prob (x) = x/15 for possible outcomes, x = 1, 2, 3, 4, 5

Odds For and Against

If the probability of an event is 20%, it will occur, on average, one out of five times. The "odds for" are 1-to-4 and the "odds against" are 4-to-1.

Multiplication Rule for Joint Probability

> $P(AB) = P(A \mid B) \times P(B) = P(B \mid A) \times P(A)$

The probability that A and B will both (jointly) occur is the probability of A given that B occurs, multiplied by the (unconditional) probability that B will occur.

Addition Rule

> $P(A \text{ or } B) = P(A) + P(B) - P(AB)$
>
> If A and B are mutually exclusive, $P(AB)$ is zero and $P(A \text{ or } B) = P(A) + P(B)$

Used to calculate the probability that at least one (one or both) of two events will occur.

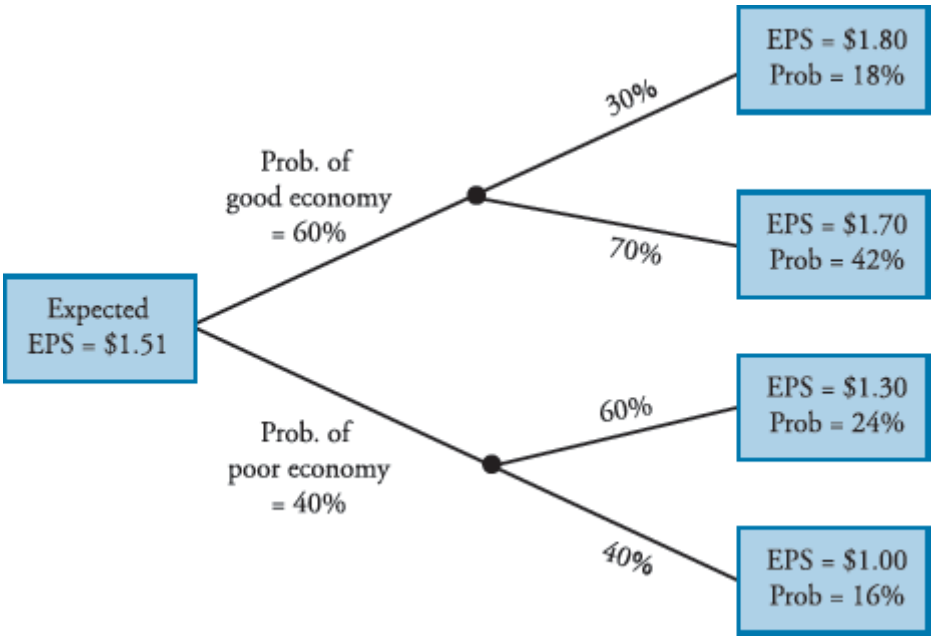
Total Probability Rule

> $P(R) = P(R \mid I) \times P(I) + P(R \mid I^C) \times P(I^C)$

where: I and I^C are *mutually exclusive and an exhaustive set of events* (i.e., if I occurs, then I^C cannot occur and one of the two must occur).

A **probability tree** shows a variety of possible outcomes for a random variable, such as an asset price or earnings per share.

Figure 3: A Probability Tree for an Investment Problem



We can illustrate several probability concepts with a probability tree. The (unconditional) expected EPS is the sum of the possible outcomes, weighted by their probabilities.

$$0.18 \times 1.80 + 0.42 \times 1.70 + 0.24 \times 1.30 + 0.16 \times 1.00 = \$1.51$$

The (conditional) expectation of EPS, given that the economy is good, is $\$1.73 = 0.3(1.80) + 0.7(1.70)$. Expected EPS, given that the economy is poor, is $0.6(1.30) + 0.4(1.00) = \$1.18$.

The probabilities of each of the EPS outcomes are simply the product of the two probabilities along the (branches) of the tree [e.g., $P(\text{EPS} = \$1.80) = 0.6 \times 0.3 = 18\%$].

Covariance

The *covariance* between two variables is a measure of the degree to which the two variables tend to move together. It captures the linear relationship between one random variable and another.

A *positive covariance* indicates that the variables tend to move together; a *negative covariance* indicates that the variables tend to move in opposite directions relative to their means. Covariance indicates the direction of the relationship and does not directly indicate the strength of the relationship. Therefore, if you compare the covariance measures for two sets of (paired) random variables and the second is twice the value of the first, the relationship of the second set isn't necessarily twice as strong as the first because the variance of the variables may be quite different as well.

EXAMPLE

Covariance can be calculated using a joint probability table as follows:

	$R_X = 15\%$	$R_X = 10\%$
$R_Y = 20\%$	0.30	0
$R_Y = 5\%$	0	0.70

First, find the expected returns on X and Y:

$E(R_X) = 0.30(15) + 0.70(10) = 11.5\%$

$E(R_Y) = 0.30(20) + 0.70(5) = 9.5\%$

Next calculate the covariance:

$$\begin{aligned}\text{Cov}(R_X, R_Y) &= \left[0.3(15.0 - 11.5)(20.0 - 9.5)\right] \\ &\quad + \left[0.7(10.0 - 11.5)(5.0 - 9.5)\right] \\ &= 11.025 + 4.725 = 15.75\end{aligned}$$

Correlation

The *correlation coefficient*, *r*, is a standardized measure (unlike covariances) of the strength of the linear relationship between two variables. The correlation coefficient can range from –1 to +1.

$$r = \text{corr}(R_i, R_j) = \frac{\text{Cov}(R_i, R_j)}{\sigma(R_i)\sigma(R_j)}$$

A correlation of +1 indicates a perfect positive correlation. In that case, knowing the outcome of one random variable would allow you to predict the outcome of the other with certainty.

Care should be taken when drawing conclusions based on correlation. Causation is not implied just from significant correlation. Even if it were, which variable is "causing" change in the other is not indicated by correlation. It is more prudent to say that two variables exhibit positive or negative association. Two variables may exhibit **spurious correlation** that is either the result of chance or their association with a third variable.

Scatter plots are a method for displaying the relationship between two variables. A key advantage of creating scatter plots is that they can reveal non-linear relationships, which are not captured by the correlation coefficient.

Expected Return and Variance of a Portfolio of Two Stocks

Know how to compute the *expected return and variance for a portfolio of two assets* using the following formulas:

$$E(R_P) = w_A R_A + w_B R_B$$
$$\text{Var}_p = w_A^2\sigma_A^2 + w_B^2\sigma_B^2 + 2w_A w_B \sigma_A \sigma_B \rho_{A,B}$$

$$\text{Var}_p = w_A^2\sigma_A^2 + w_B^2\sigma_B^2 + 2w_A w_B \text{Cov}_{A,B}$$

Note that $\sigma_A\sigma_B\rho_{A,B} = \text{Cov}_{A,B}$ so the formula for variance can be written either way.

COMMON PROBABILITY DISTRIBUTIONS

Critical topics to understand include the normal distribution and areas under the normal curve, the *t*-distribution, skewness, kurtosis, and the binomial distribution. Be able to calculate confidence intervals for population means based on the normal distribution.

Discrete random variable: A limited (finite) number of possible outcomes and each has a positive probability. They can be counted (e.g., number of days without rain during a month).

Continuous random variable: An infinite number of possible outcomes. The number of inches of rain over a month can take on an infinite number of values, assuming we can measure it with infinite precision. For a continuous random variable, the probability that the random variable will take on any single one (of the infinite number) of the possible values is zero.

Probability function, p(x), specifies the probability that a random variable equals a particular value, x.

A *cumulative density function* (CDF), for either a discrete or continuous distribution, gives the probability that a random variable will take on a value *less than or equal to* a specific value, that is, the probability that the value will be between minus infinity and the specified value.

For the function, Prob(x) = x/15 for x = 1, 2, 3, 4, 5, the CDF is:

$$\sum_{x=1}^{X} \frac{x}{15}, \text{ so that } F(3) \text{ or } \text{Prob}\,(x \leq 3) \text{ is } 1/15 + 2/15 + 3/15 = 6/15 \text{ or } 40\%$$

This is simply the sum of the probabilities of 1, 2, and 3. Note that Prob(x = 3, 4) can be calculated as $F(4) - F(2) = \frac{10}{15} - \frac{3}{15} = \frac{7}{15}$.

Uniform Distributions

With a uniform distribution, the probabilities of the outcomes can be thought of as equal. They are equal for all possible outcomes with a discrete uniform distribution, and equal for equal-sized ranges of a uniform continuous distribution.

For example, consider the *discrete uniform probability distribution* defined as X = {1, 2, 3, 4, 5}, p(x) = 0.2. Here, the probability for each outcome is equal to 0.2 [i.e., p(1) = p(2) = p(3) = p(4) = p(5) = 0.2]. Also, the cumulative distribution function for the *n*th outcome, $F(x_n)$ = np(x), and the probability for a range of outcomes is p(x)k, where *k* is the number of possible outcomes in the range.

A *continuous uniform distribution* over the range of 1 to 5 results in a 25% probability [1 / (5 − 1)] that the random variable will take on a value between 1 and 2, 2 and 3, 3 and 4, or 4 and 5, since 1 is one-quarter of the total range of the random variable.

The Binomial Distribution

A **binomial random variable** may be defined as the number of “successes” in a given number of trials where the outcome can be either “success” or “failure.” You can recognize

problems based on a binomial distribution from the fact that there are only two possible outcomes (e.g., the probability that a stock index will rise over a day's trading). The probability of success, *p*, is constant for each trial, the trials are independent, and the probability of failure (no success) is simply 1 − p. A binomial distribution is used to calculate the number of successes in *n* trials. The probability of *x* successes in *n* trials is:

$$p(x) = P(X = x) = ({}_nC_r)p^x(1-p)^{n-x}$$

and the expected number of successes is *np*.

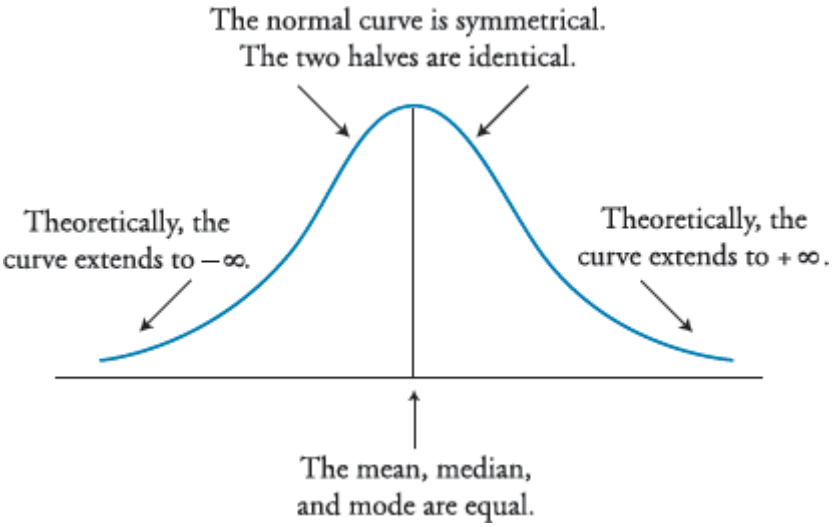
If the probability of a stock index increasing each day (*p*) is 60%, the probability (assuming independence) that the index will increase on exactly three of the next five days (and not increase on two days) is $({}_5C_3)0.6^3(1-0.6)^2 = 0.3456$.

Normal Distribution: Properties

- Completely described by mean and variance.
- Symmetric about the mean (skewness = 0).
- Kurtosis (a measure of peakedness) = 3.
- Linear combination of jointly, normally distributed random variables is also normally distributed.

Many properties of the normal distribution are evident from examining the graph of a normal distribution's probability density function:

Figure 4: Normal Distribution Probability Density Function



Calculating Probabilities Using the Standard Normal Distribution

The *z-value* "standardizes" an observation from a normal distribution and represents the number of standard deviations a given observation is from the population mean.

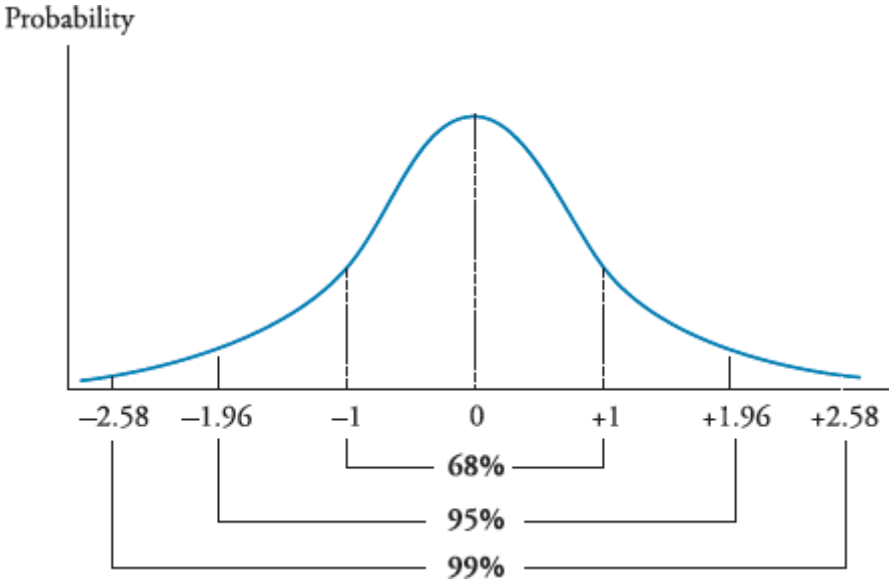
$$z = \frac{\text{observation} - \text{population mean}}{\text{standard deviation}} = \frac{x-\mu}{\sigma}$$

Confidence Intervals: Normal Distribution

A *confidence interval* is a range of values around an expected outcome within which we expect the actual outcome to occur some specified percentage of the time.

The following graph illustrates confidence intervals for a standard normal distribution, which has a mean of 0 and a standard deviation of 1. We can interpret the values on the x-axis as the number of standard deviations from the mean. Thus, for any normal distribution we can say, for example, that 68% of the outcomes will be within one standard deviation of the mean. This would be referred to as a 68% confidence interval.

Figure 5: The Standard Normal Distribution and Confidence Intervals



Be prepared to calculate a confidence interval on the Level I exam. Consider a normal distribution with mean μ and standard deviation σ. Each observation has an expected value of μ. If we draw a sample of size *n* from the distribution, the mean of the sample has an expected value of μ. The larger the sample, the closer to μ we expect the sample mean to be. The standard deviation of the means of samples of size *n* is simply $\sigma/\sqrt{n}$ and is called standard error of the sample mean. This allows us to construct a confidence interval for the sample mean for a sample of size *n*.

EXAMPLE

Calculate a 95% confidence interval for the mean of a sample of size 25 drawn from a normal distribution with a mean of 8 and a standard deviation of 4.

Answer:

The standard deviation of the means of samples of size 25 is:

$$4/\sqrt{25} = 4/5 = 0.8$$

A 95% confidence interval will extend 1.96 standard deviations above and below the mean, so our 95% confidence interval is:

8 ± 1.96 × 0.8, 6.432 to 9.568

> We believe the mean of a sample of 25 observations will fall within this interval 95% of the time.

With a known variance, the formula for a confidence interval is:

$$\bar{x} \pm z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$$

In other words, the confidence interval is equal to the mean value, plus or minus the *z*-score that corresponds to the given significance level multiplied by the standard error.

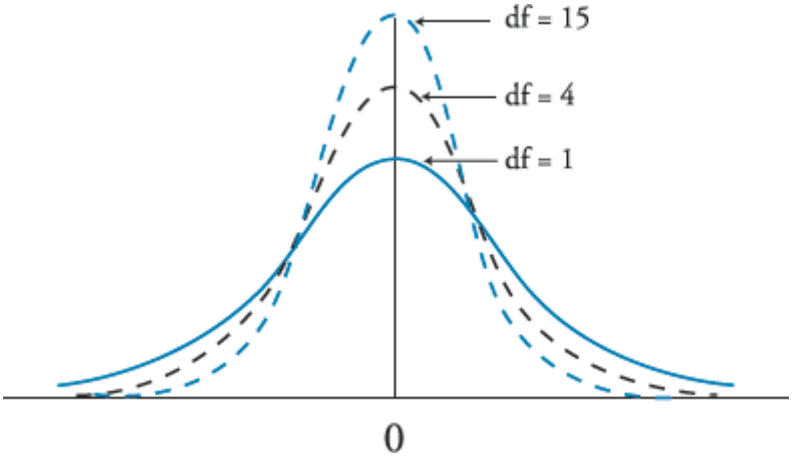
- Confidence intervals and *z*-scores are very important in hypothesis testing, a topic that will be reviewed shortly.

Student's *t*-Distribution

- Symmetrical (bell shaped).
- Defined by single parameter, degrees of freedom (df), where df = n − 1 for hypothesis tests and confidence intervals involving a sample mean.
- Has fatter tails than a normal distribution; the lower the df, the fatter the tails and the wider the confidence interval around the sample mean for a given probability that the interval contains the true mean.
- As sample size (degrees of freedom) increases, the *t*-distribution approaches normal distribution.

Student's t-distribution is similar in concept to the normal distribution in that it is bell-shaped and symmetrical about its mean. The *t*-distribution is appropriate when working with small samples (n < 30) from populations with *unknown variance* and normal, or approximately normal, distributions. It may also be appropriate to use the *t*-distribution when the population variance is unknown and the sample size is large enough that the central limit theorem will ensure the sampling distribution is approximately normal.

Figure 6: Student's *t*-Distribution and Degrees of Freedom



Shortfall Risk and Safety-First Ratio

Shortfall risk. The probability that a portfolio's return or value will be below a specified (target) return or value over a specified period.

Roy's safety-first criterion states that the optimal portfolio minimizes the probability that the return of the portfolio falls below some minimum acceptable "threshold" level.

Roy's safety-first ratio (SFRatio) is the mean return minus the threshold return, divided by the standard deviation of returns. A portfolio with a higher SFRatio is preferred.

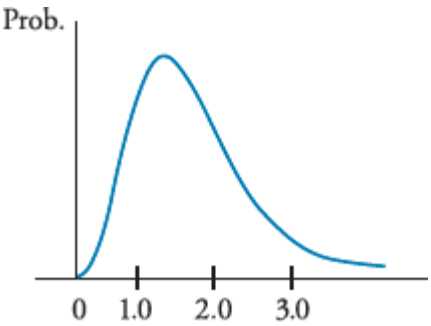
$$\text{SFRatio} = \frac{E(R_p) - R_L}{\sigma_p}$$

With approximate normality of returns, the SFRatio is like a *t*-statistic. It shows how many standard deviations the expected return is above the threshold return (R_L). The greater the SFRatio, the lower the probability that returns will be below the threshold return (i.e., the lower the shortfall risk).

Lognormal Distribution

If *x* is normally distributed, $Y = e^x$ is lognormally distributed. Values of a lognormal distribution are always positive so it is used to model asset prices (rather than rates of return, which can be negative). The lognormal distribution is positively skewed as shown in the following figure.

Figure 7: Lognormal Distribution



Continuously Compounded Returns

If we increase the number of compounding periods (*n*) for an annual rate of return, the limit as *n* goes toward infinity is continuous compounding. For a specific holding period return (HPR), the relation to the continuously compounded return (CCR) over the holding period is as follows:

$$\text{CCR} = \ln(1 + \text{HPR}) = \ln\left(\frac{\text{ending value}}{\text{beginning value}}\right)$$

$$\text{HPR} = \frac{\text{ending value}}{\text{beginning value}} - 1 = e^{\text{CCR}} - 1$$

When the holding period is one year, so that HPR is also the effective annual return, CCR is the annual continuously compounded rate of return.

One property of continuously compounded rates is that they are additive over multiple periods. If the continuously compounded rate of return is 8%, the holding period return over a 2-year horizon is $e^{2(0.08)} - 1$, and \$1,000 will grow to 1,000 $e^{2.5(0.08)}$ over 2½ years.

Chi-Square and *F* Distributions

The **chi-square distribution** is the distribution of the sum of the squared values of *n* random variables, and *k*, the degrees of freedom, is equal to n – 1.

The chi-square distribution is bounded from below by zero. It is typically asymmetric, but its symmetry increases with the degrees of freedom. As degrees of freedom get larger, the chi-square distribution approaches the normal distribution in shape.

The ***F*-distribution** is the distribution of the quotient of two (appropriately scaled) independent chi-square variables with degrees of freedom *m* and *n*:

$$F = \frac{\chi^2/m}{\chi^2/n}$$

The numerator is a χ^2 variable with *m* degrees of freedom and the denominator is a χ^2 variable with *n* degrees of freedom.

A common use of the *F*-distribution is to determine the probability that the variances of two independent normal distributions are equal. The *F*-distribution cannot take on negative values. Therefore, like the chi-square distribution, it is bounded from below by zero. The *F*-distribution is also asymmetric. As the numerator and denominator degrees of freedom increase, the *F*-distribution becomes more symmetric and its shape becomes more like the bell curve of a normal distribution.

Simulation

Monte Carlo simulation is performed by making assumptions about the distributions of prices or risk factors and using a large number of computer-generated random values for the relevant risk factors or prices to generate a distribution of possibly outcomes (e.g., project NPVs, portfolio values). The simulated distributions can only be as accurate as the assumptions about the distributions of and correlations between the input variables assumed in the procedure.

SAMPLING AND ESTIMATION

Know the methods of sampling, sampling biases, and the central limit theorem, which allows us to use sampling statistics to construct confidence intervals around point estimates of population means.

- **Probability sampling** refers to selecting a sample when we know the probability of each sample member in the overall population.
- **Non-probability sampling** is based on either low cost or easy access to some data items, or on using the judgment of the researcher in selecting specific data items. Less randomness in selection may lead to greater sampling error.

- **Sampling error:** Difference between the sample statistic and its corresponding population parameter:

> $$\text{sampling error of the mean} = \bar{x} - \mu$$

- **Simple random sampling:** Method of selecting a sample such that each item or person in the population has the *same likelihood of being included* in the sample.
- **Stratified random sampling:** Separate the population into groups based on one or more characteristics. Take a random sample from each class based on the group size. In constructing bond index portfolios, we may first divide the bonds by maturity, rating, call feature, etc., and then pick bonds from each group of bonds in proportion to the number of index bonds in that group. This insures that our "random" sample has similar maturity, rating, and call characteristics to the index.
- **Cluster sampling** is also based on subsets of a population, but assumes that each subset (cluster) is representative of the overall population. In **one-stage cluster sampling**, a random sample of clusters is selected and all the data in those clusters comprise the sample. In **two-stage cluster sampling**, random samples from each of the selected clusters comprise the sample. To the extent that the subgroups do not have the same distribution as the entire population of the characteristic we are interested in, cluster sampling will have greater sampling error than simple random sampling and two-stage cluster sampling can be expected to have greater sampling error than one-stage cluster sampling.
- **Convenience sampling** refers to selecting sample data based on its ease of access, using data that are readily available.
- **Judgmental sampling** refers to samples for which each observation is selected from a larger data set by the researcher, based on her experience and judgment.

Sample Biases

- **Data snooping bias** occurs when research is based on the previously reported empirical evidence of others, rather than on the testable predictions of a well-developed economic theory. Data snooping bias also occurs when analysts repeatedly use the same database to search for patterns or trading rules until one that "works" is found.
- **Sample selection bias** occurs when some data is systematically excluded from the analysis, usually because of the lack of availability.
- **Survivorship bias** is the most common form of sample selection bias. A good example of survivorship bias is given by some studies of mutual fund performance. Most mutual fund databases, like Morningstar's, only include funds currently in existence—the "survivors." Since poorly performing funds are more likely to have ceased to exist because of failure or merger, the survivorship bias in the data set tends to bias average performance upward.
- **Look-ahead bias** occurs when a study tests a relationship using sample data that was not available on the test date.
- **Time-period bias** can result if the time period over which the data is gathered is either too short or too long.

Central Limit Theorem

The *central limit theorem* of statistics states that in selecting simple random samples of size *n* from a *population* with a mean μ and a finite variance σ^2, the sampling distribution of the sample mean approaches a normal probability distribution with mean μ and a variance equal to σ^2/n as the sample size becomes large.

The central limit theorem is extremely useful because the normal distribution is relatively easy to apply to hypothesis testing and to the construction of confidence intervals.

Specific inferences about the population mean can be made from the sample mean, *regardless of the population's distribution*, as long as the sample size is sufficiently large.

The standard error of the sample mean is the standard deviation of the sample divided by the square root of *n*, the number of observations in the sample: $s/\sqrt{n}$. We use the standard error to construct a confidence interval for the actual mean of the population. For example, with a large sample size, a 95% confidence interval for the population mean is the sample mean ±1.96 standard errors.

There are alternatives to using the standard error of the sample mean as we calculated it. With the **jackknife method**, we calculate multiple sample means, each with one of the observations removed from the sample. The standard deviation of these sample means can then be used as an estimate of the standard error of sample means.

With the more computationally demanding **bootstrap method**, we draw repeated samples of size *n* from the full data set (replacing the sampled observations each time) and then calculate the standard deviation of these means. The bootstrap method can be used to estimate the distributions of complex statistics, including those that do not have an analytic form.

For questions on the exam, make sure you are working with the correct distribution. You should memorize the following table:

Figure 8: Criteria for Selecting Test Statistic

When sampling from a:	Test Statistic	
	Small Sample (n < 30)	Large Sample (n ≥ 30)
Normal distribution with *known* variance	z-statistic*	z-statistic
Normal distribution with *unknown* variance	t-statistic	t-statistic**
Nonnormal distribution with *known* variance	not available	z-statistic
Nonnormal distribution with *unknown* variance	not available	t-statistic**

* The z-statistic is the standard normal, ±1 for 68% confidence, et cetera.

** The z-statistic is theoretically acceptable here, but use of the t-statistic is more conservative.

The desirable properties of an estimator are as follows:

- *Unbiased*. Expected value of the estimator is the true value of the statistic being estimated.
- *Efficient*. Estimator has the lowest variance of any unbiased estimator.
- *Consistent*. Estimate is more accurate as the sample size is increased.

HYPOTHESIS TESTING

Hypothesis. Statement about a population parameter that is to be tested. For example, "The mean return on the S&P 500 Index is equal to zero."

Steps in Hypothesis Testing

- State the hypothesis.
- Select a test statistic.
- Specify the level of significance.
- State the decision rule for the hypothesis.
- Collect the sample and calculate statistics.
- Make a decision about the hypothesis.
- Make a decision based on the test results.

Null and Alternative Hypotheses

The *null hypothesis*, designated as H_0, is the hypothesis the researcher wants to reject. It is the hypothesis that is actually tested and is the basis for the selection of the test statistics. Thus, if you believe (seek to show that) the mean return on the S&P 500 Index is different from zero, the null hypothesis will be that the mean return on the index *equals* zero.

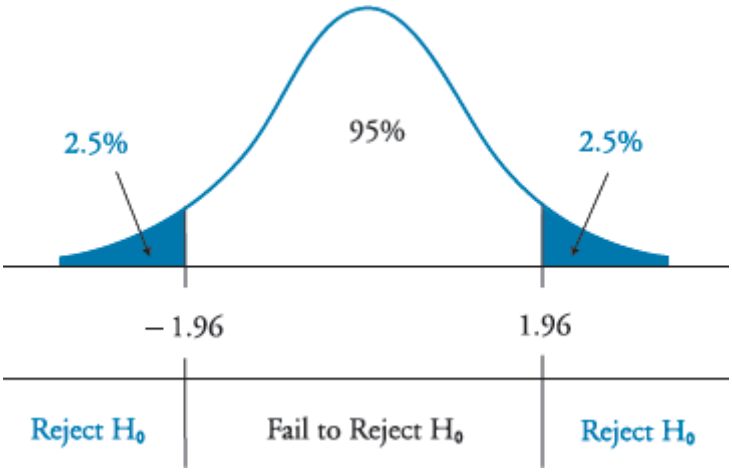
The *alternative hypothesis*, designated H_a, is what is concluded if there is sufficient evidence to reject the null hypothesis. It is usually the alternative hypothesis you are really trying to support. Why? Since you can never really prove anything with statistics, when the null hypothesis is rejected, the implication is that the (mutually exclusive) alternative hypothesis is valid.

Two-Tailed and One-Tailed Tests

Two-tailed test. Use this type of test when testing a parameter to see if it is different from a specified value:

> $H_0: \mu = 0$ versus $H_a: \mu \neq 0$

Figure 9: Two-Tailed Test: Significance = 5%, Confidence = 95%

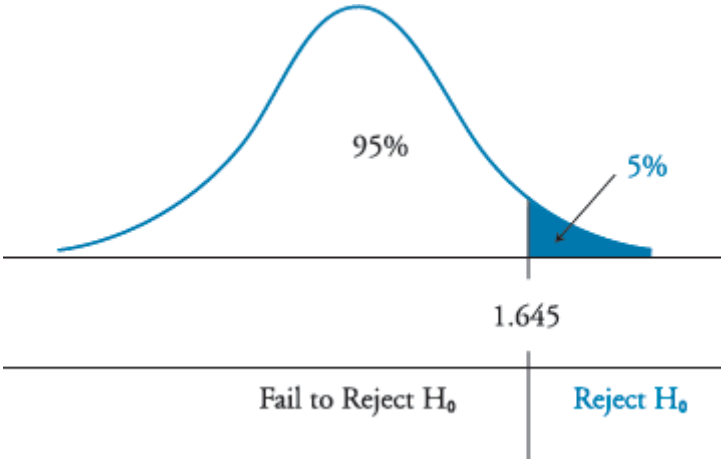


One-tailed test. Use this type of test when testing a parameter to see if it is *above* or *below* a specified value:

> H_0: $\mu \leq 0$ versus H_a: $\mu > 0$, or
>
> H_0: $\mu \geq 0$ versus H_a: $\mu < 0$

With respect to the first hypothesis, $\mu \leq 0$, we will reject it only if the test statistic is significantly greater than zero (in the right-hand tail of the distribution). Thus, we call it a one-tailed test.

Figure 10: One-Tailed Test: Significance = 5%, Confidence = 95%



Test Statistic

A *test statistic* is calculated from sample data and is compared to a critical value to evaluate H_0. The most common test statistics are the *z*-statistic and the *t*-statistic. Which statistic you use to perform a hypothesis test will depend on the properties of the population and the sample size as noted previously.

- Critical values come from tables and are based on the researcher's desired level of significance. As the level of significance (the α) gets smaller, the critical value gets larger and it becomes more difficult to reject the null hypothesis.
- If the test statistic exceeds the critical value (or is outside the range of critical values), the researcher rejects H_0.

Type I and Type II Errors

When testing a hypothesis, there are two possible types of errors:

- *Type I error*. Rejection of the null hypothesis when it is actually true.
- *Type II error*. Failure to reject the null hypothesis when it is actually false.

The *power of a test* is 1 − P(Type II error). The more likely that a test will reject a false null, the more powerful the test. A test that is unlikely to reject a false null hypothesis has little power.

Significance Level (α)

The *significance level* is the probability of making a Type I error (rejecting the null when it is true) and is designated by the Greek letter alpha (α). You can think of this as the probability that the test statistic will exceed or fall below the critical values by chance even though the null hypothesis is true. A significance level of 5% (α = 0.05) means there is a 5% chance of rejecting a true null hypothesis.

Figure 11: Errors in Hypothesis Testing

Type I and Type II Errors in Hypothesis Testing		
Decision	True Condition	
	H_0 is true	H_0 is false
Do not reject H_0	Correct decision	Incorrect decision Type II error
Reject H_0	Incorrect decision Type I error Significance level, α, = P(Type I error)	Correct decision Power of the test = 1 − P(Type II error)

Economically Meaningful Results

A test may indicate a significant statistical relationship (a statistically meaningful result) which is not economically significant. This is often the case when the gains from exploiting the statistical relation are small in an absolute sense so that the costs of a strategy to exploit the relation are greater than the expected gains from the strategy.

p-Values

The ***p*-value** of a test statistic is the lowest significance value that will result in rejection of the null hypothesis.

When the results from **multiple hypothesis tests** are combined, the significant *p*-values from the tests can be ranked from lowest to highest, and adjusted significance levels can be calculated based on these ranks. We can then determine the proportion of all tests for which the *p*-value is less than the adjusted significance level. If that proportion is less than the significance level (e.g., 5%), the null hypothesis is rejected.

Other Hypothesis Tests

A test of the equality of the means of two independent normally distributed populations is a *t*-test based on the difference in sample means divided by a standard deviation which is calculated in one of two ways, depending on whether the variances of the two populations are assumed to be equal or not.

When random variables from two populations are dependent, the appropriate test is a *mean differences* or *paired comparisons* test. The test statistic is a *t*-statistic based on the average (mean) of the differences in the sample of the paired values of the two random variables, divided by the standard deviation of the differences between the sample pairs.

A test of whether the population variance of a normal distribution is equal to a specific value is based on the ratio of the sample variance to the hypothesized variance. The test statistic follows a Chi-square distribution and is a two-tailed test.

A test of whether the variances of two normal populations are equal is based on the ratio of the larger sample variance to the smaller sample variance. The appropriate test is an *F*-test (two-tailed), but by putting the larger sample variance in the numerator, values of the test statistic below the lower critical value are ruled out, and only the upper critical value of the *F*-statistic need be considered.

A hypothesis test of whether the population correlation coefficient is equal to zero follows a t-distribution with n – 2 degrees of freedom. Its test statistic increases with the sample size as well as with the sample correlation coefficient.

A hypothesis test of whether two characteristics of a sample are independent uses a Chi-square statistic calculated from a contingency table. The test compares the actual table values to what the values would be if the two characteristics were independent.

The following table summarizes the test statistics used for each type of hypothesis test.

Figure 12: Types of Test Statistics

Hypothesis tests of:	Use a:	With degrees of freedom:
One population mean	*t*-statistic	$n - 1$
Two population means	*t*-statistic	$n - 1$
One population variance	Chi-square statistic	$n - 1$
Two population variances	*F*-statistic	$n_1 - 1, n_2 - 1$
Correlation	*t*-statistic	$n - 2$
Independence	Chi-square statistic	(rows – 1) × (columns – 1)

Parametric and Nonparametric Tests

Parametric tests, like the *t*-test, *F*-test, and chi-square test, make assumptions regarding the distribution of the population from which samples are drawn.

Nonparametric tests either do not consider a particular population parameter or have few assumptions about the sampled population. Runs tests (which examine the pattern of successive increases or decreases in a random variable) and rank correlation tests (which

examine the relation between a random variable's relative numerical rank over successive periods) are examples of nonparametric tests.

INTRODUCTION TO LINEAR REGRESSION

Simple linear regression is used to estimate the linear relationship between two variables and evaluate the significance of the relationship. A researcher determines which variable likely explains the variation in the other.

The **dependent variable** (the *Y* variable) is also referred to as the explained variable, the endogenous variable, or the predicted variable.

The **independent variable** (the *X* variable) is also referred to as the explanatory variable, the exogenous variable, or the predicting variable.

The following **linear regression model** is used to describe the relationship between variables *X* (independent) and *Y* (dependent):

$$Y_i = b_0 + b_1 X_i + \varepsilon_i, \text{ with } i = 1 \text{ to } n$$

where:

Y_i = *i*th observation of the dependent variable, Y

X_i = *i*th observation of the independent variable, X

b_0 = regression intercept term

b_1 = regression slope coefficient

ε_i = **residual** for the *i*th observation (also referred to as the error term)

Based on this regression model, the regression process estimates an equation for a line through a scatter plot of the data that best explains the observed values for *Y* in terms of the observed values for *X*. This **regression line** takes the following form:

$$\hat{Y}_i = \hat{b}_0 + \hat{b}_1 X_i, \text{ for } i = 1 \text{ to } n$$

where:

$\hat{Y}_i$ = estimated value of Y_i given X_i

$\hat{b}_0$ = estimated intercept term

$\hat{b}_1$ = estimated **slope coefficient**

The regression line is the line through the scatter plot of *X* and *Y* that minimizes the sum of the squared errors [differences between the *Y*-values predicted by the regression equation $\hat{Y}_i$ and the observed *Y*-values (Y_i)]. The sum of these squared differences is called the **sum of squared errors (SSE)**.

The slope coefficient for the regression line is an estimate of the change in *Y* for a one-unit change in *X*. The slope term is calculated as follows:

$$\hat{b}_1 = \frac{Cov_{XY}}{\sigma_X^2}$$

The **intercept term** is the regression line's intersection with the *Y*-axis at X = 0. The intercept term may be expressed as follows:

$$\hat{b}_0 = \bar{Y} - \hat{b}_1 \bar{X}$$

In other words, the regression line passes through a point with coordinates equal to the means of the independent and dependent variables.

Assumptions of Simple Linear Regression

Linear regression assumes the following:

1. A linear relationship exists between the dependent and the independent variables.
2. The variance of the residual term is constant for all observations (homoskedasticity). **Heteroskedasticity** refers to the situation when this assumption is violated.
3. The residual term is independently distributed; that is, the residual for one observation is not correlated with that of another observation.
4. The residual term is normally distributed.

Analysis of Variance (ANOVA)

ANOVA is a statistical procedure for analyzing the total variation in the dependent variable. Three of the measures in an ANOVA table are as follows:

- **Sum of squares total (SST).** Sum of the squared differences between the actual *Y*-values and the mean of *Y*. SST measures the total variation in the dependent variable.
- **Sum of squares regression (SSR).** Sum of the squared differences between the predicted *Y*-values and the mean of *Y*. SSR measures the variation in the dependent variable that *is* explained by the independent variable.
- **Sum of squared errors (SSE).** Sum of the squared differences between the actual *Y*-values and the predicted *Y*-values. SSE measures the variation in the dependent variable that *is not* explained by the dependent variable.

From these, we can calculate the **coefficient of determination**, or ***R*-squared**, which is the proportion of the total variation in the dependent variable that is explained by the independent variable:

$$R^2 = SSR / SST$$

The **mean square regression (MSR)** is equal to the SSR divided by the regression's degrees of freedom. For a simple linear regression the degrees of freedom are one, because we have one independent variable.

The **mean squared error (MSE)** is the SSE divided by its degrees of freedom, which for a simple linear regression is the number of observations minus two.

$$\text{MSE} = \frac{\text{SSE}}{n-2}$$

The **standard error of estimate (SEE)** for a regression is the standard deviation of its residuals. The lower the SEE, the better the model fit.

$$\text{SEE} = \sqrt{\text{MSE}}$$

Dividing the MSR by the MSE gives us an ***F*-statistic** that we can use to test whether the slope coefficient is statistically significant.

$$F = \text{MSR} / \text{MSE}$$

Hypothesis Test of the Slope Coefficient

For a simple linear regression, the *F*-test is equivalent to a *t*-test of the significance of the estimated slope coefficient (b_1). The test statistic is as follows:

$$t = \frac{\hat{b}_1 - b_1}{s_{\hat{b}_1}}$$

where:

b_1 = hypothesized value of slope coefficient

$s_{\hat{b}_1}$ = standard error of slope coefficient = $\frac{\text{SEE}}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2}}$

Degrees of freedom for this *t*-test are n – 2. The null hypothesis is that $b_1 = 0$ (the independent variable has no significant explanatory power for the value of the dependent variable).

Predicted Values and Confidence Intervals

We use a regression model to predict values of the dependent variable, given predicted values for the independent variable. For example, given the following regression equation:

$$\hat{Y} = -2.3\% + 0.64\hat{X}$$

If we have a forecast value for *X* of 10%, the predicted value of *Y* is –2.3% + 0.64(10%) = 4.1%.

We can construct a confidence interval around the predicted value, as follows:

$$Y \pm (t_c \times s_f)$$

where:

t_c = two-tailed critical *t*-value at the desired level of significance with df = n – 2

s_f = standard error of the forecast = $\text{SEE}^2\left[1 + \frac{1}{n} + \frac{(X - \bar{X})^2}{(n-1)s_X^2}\right]$

On the Level I exam, we believe any question that requires the standard error of the forecast is highly likely to provide a value for it.

Linear Regression with Transformed Variables

If one or both of the variables appear to be growing at a constant rate in percentage terms (constant compound, or exponential, rate of growth), we can transform them using the natural logarithm and then apply simple linear regression. Such a model is called a **log-lin model** if the dependent variable is transformed while the independent variable is linear, a **lin-log model** if the independent variable is transformed while the dependent variable is linear, or a **log-log model** if both variables are transformed.

ECONOMICS

Weight on Exam	8% to 12%
SchweserNotes™ Reference	Book 1, Pages 219–399

TOPICS IN DEMAND AND SUPPLY ANALYSIS

Elasticity

Price elasticity of demand is the ratio of the percent change in quantity demanded to the percent change in price.

Income elasticity of demand is the ratio of the percent change in quantity demanded to the percent change in income. For a normal good, income elasticity is positive so that an increase in income increases demand for the good. For an inferior good, income elasticity is negative so that an increase in income decreases demand for the good (e.g., bus travel).

Cross price elasticity of demand is the ratio of the percent change in quantity demanded to the percent change in the price of a related good. It is positive for a good that is a substitute in consumption (e.g., cars and bus travel) and negative for a good that is a complement in consumption (e.g., cars and gasoline).

For a demand function of the general form: $Q_D = 100 - A \times P_{good} + B \times Income + C \times P_{other\ good}$, at price and quantity P* and Q*:

- **The price elasticity of demand is A × (P*/Q*)**. If A < 1, an increase (decrease) in price will increase (decrease) total revenue; if A > 1, an increase (decrease) in price will decrease (increase) total revenue.
- **The income elasticity of demand is B × (Income/Q*)** and is positive (B > 0) for normal goods and negative (B < 0) for inferior goods (an increase in income decreases quantity demanded of the good).
- **The cross price elasticity of demand is C × Pother good /Q***. When C is negative, the goods are complements, and when C is positive, the goods are substitutes.

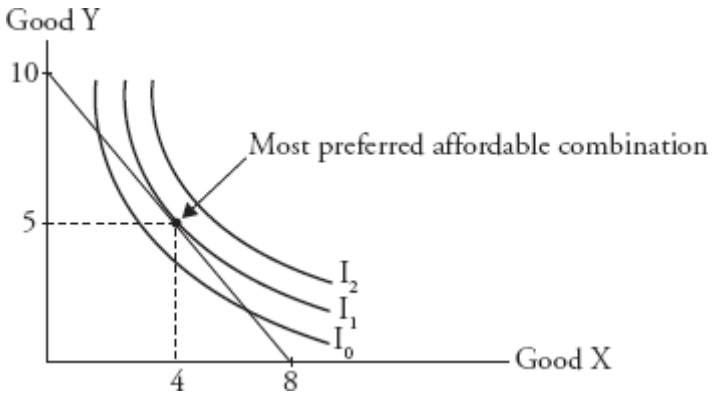
Income and Substitution Effects

A **budget line** represents all the combinations of two goods that will just exhaust a consumer's income. A budget line bounds an area representing all affordable combinations of two goods at current prices. The y-intercept of a budget line is income/price of Good Y, and the x-intercept is income/price of Good X.

An indifference curve for an individual that is higher than (to the north-east of) another represents a set of more preferred bundles of goods. By combining an individual's indifference curves with that individual's budget constraint, we can illustrate the choice of the most preferred affordable bundle as the combination of goods along the budget line that lies on the highest attainable indifference curve. Graphically, this is the point where one of an individual's indifference curves is just tangent to his budget constraint.

We illustrate this result in the following figure, which is consistent with an individual with an income of 200 when the price of Good Y is 20 and the price of Good X is 25.

Figure 1: A Consumer's Equilibrium Bundle of Goods



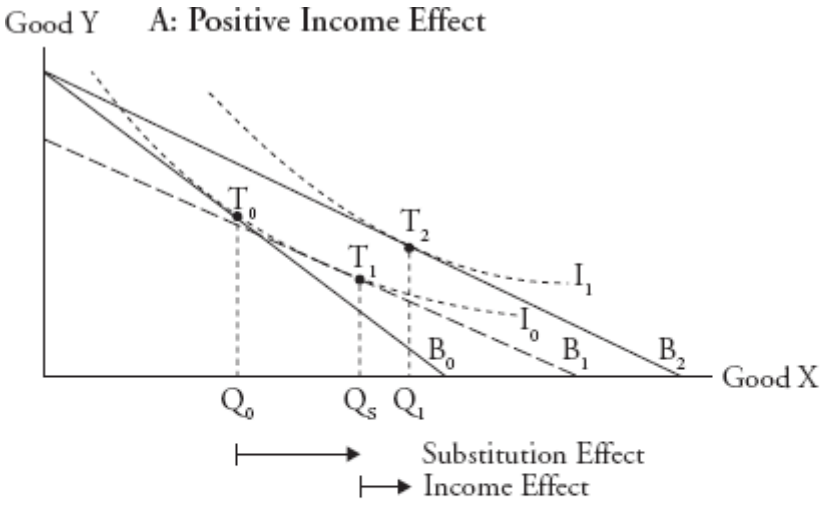
The effect of a decrease in the price of Good X is to move the x-intercept to the right (flattening the budget line), which will result in a different optimal bundle of goods. We can decompose this change into a **substitution effect**, substitution of X for Y because the relative price of Good X has decreased, and an **income effect**, approximately the effect of the income left over from consuming the original bundle of goods after the price decrease.

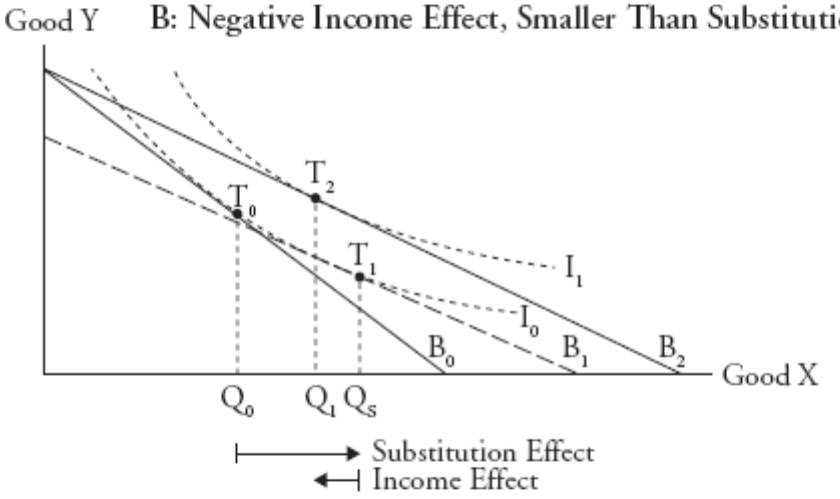
The income effect of the price decrease on consumption of Good X can theoretically be either positive or negative, depending on whether the good is normal or inferior over the relevant range of income.

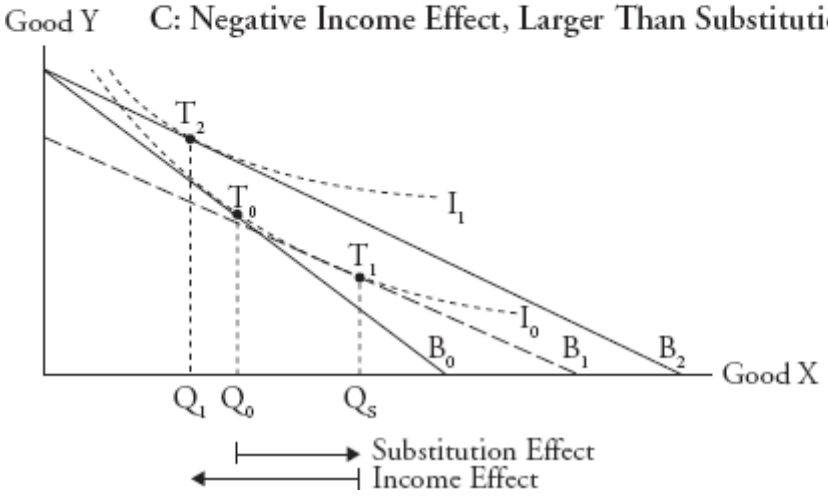
The substitution effect is the change in consumption due to the change in relative prices and is always positive (i.e., results in increased consumption of the good that decreased in price). Graphically we show this effect as a change in consumption to a point on the consumer's original tangent indifference curve, but at the point where the slope of the curve (MRS) is equal to the slope of the new budget line after the price decrease. The three possible combinations of income and substitution effects are shown graphically in Figure 2. The three combinations, different because of the income effect, are:

1. Income effect is positive so consumption of Good X increases.
2. Income effect is negative but smaller than the positive substitution effect so that consumption of Good X increases.
3. The income effect is negative and larger than the substitution effect so that consumption of Good X decreases as a result of the decrease in its price.

Figure 2: Income and Substitution Effects







In the third panel of Figure 2, a decrease in the price of the good results in a decrease in the quantity demanded. Such a good is referred to as a **Giffen good** and is consistent with utility theory and theoretically possible.

A **Veblen good** is defined as a good for which an increase in price increases its value to some consumers, so that their quantity demanded actually increases (e.g., Gucci bag). Since such goods, if they exist, are clearly not inferior, their existence is at odds with utility

theory as rational decision makers are assumed to prefer lower prices and increased consumption opportunities.

Diminishing Marginal Returns

Factors of production are the resources a firm uses to generate output. Factors of production include:

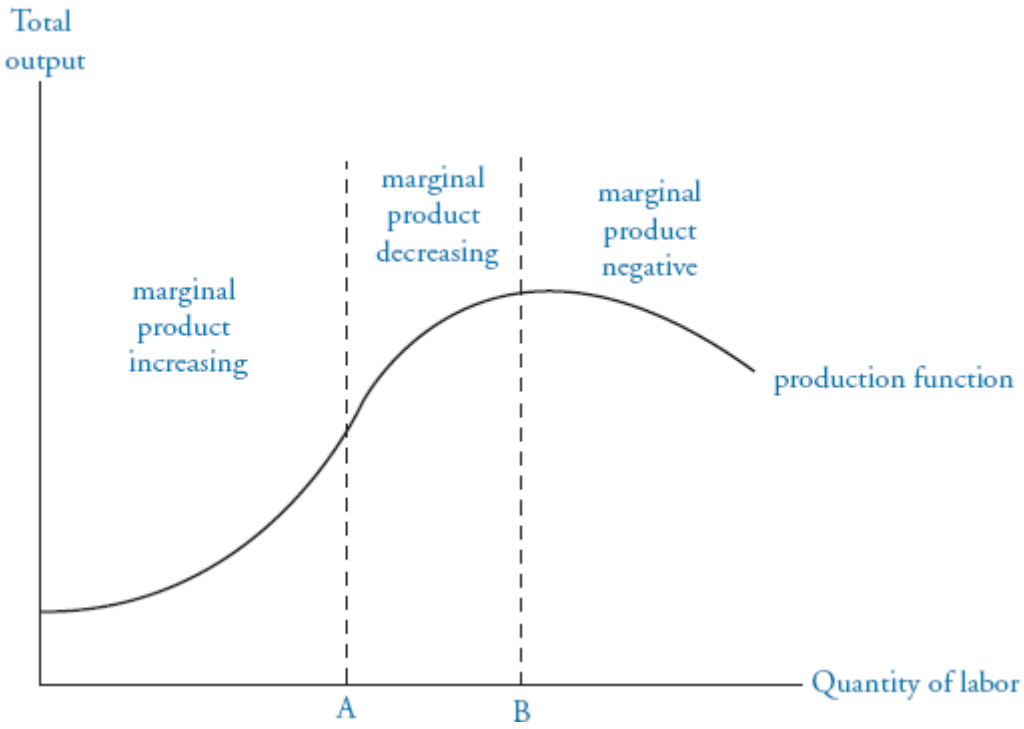
- *Land*—where the business facilities are located.
- *Labor*—includes all workers from unskilled laborers to top management.
- *Capital*—sometimes called *physical capital* or *plant and equipment* to distinguish it from financial capital. Refers to manufacturing facilities, equipment, and machinery.
- *Materials*—refers to inputs into the productive process, including raw materials and intermediate goods.

For economic analysis, we often consider only two inputs: capital and labor. The quantity of output that a firm can produce can be thought of as a function of the amounts of capital and labor employed. Such a function is called a **production function**. For a given amount of capital (a firm's plant and equipment), we can examine the increase in production (the total product of labor) that will result as we increase the amount of labor employed.

The output with only one worker is considered the **marginal product** of the first unit of labor. The addition of a second worker will increase total product by the marginal product of the second worker. The typical total product curve will at first increase at increasing rates, as additional workers increase total product by greater amounts, and marginal product is increasing with additional workers. At some point, since we are holding capital constant, each additional worker adds less and less to total product, total product increases at a decreasing rate, and the marginal product of labor decreases with additional workers. At some level of labor, additional workers may actually decrease total product (think of a very crowded factory) and the marginal product of labor is negative.

When we reach the quantity of labor for which the marginal product of labor begins to decline, we have reached the point of **diminishing marginal productivity** of labor, or that labor has reached the point of **diminishing marginal returns**. Beyond this quantity of labor, the additional output from each additional worker continues to decline. This typical assumption about the nature of labor productivity (in the short run when capital is fixed) is illustrated in Figure 3.

Figure 3: Production Function—Capital Fixed, Labor Variable

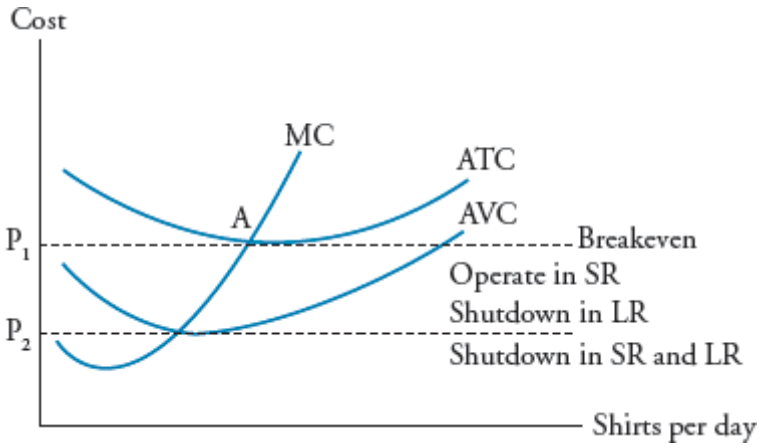


Breakeven and Shutdown

In the short run, a firm may be selling at less than average total cost (ATC), generating an economic loss. Such a firm should continue to operate in the short run as long as price is greater than average variable cost (AVC). In this case, the losses from shutting down (producing zero output) in the short run would be greater (equal to total fixed costs [TFC]) than the losses from continued operation. If selling price is less than average variable cost, the firm will minimize its losses in the short run by ceasing operations.

In the long run, a firm should shut down if price is expected to remain less than average total cost. These cases are illustrated in Figure 4. At prices below P_1 but above P_2, a profit maximizing (loss minimizing) firm should continue to operate in the short run but shut down in the long run. At prices below P_2, the firm should shut down in the short run as well. We refer to this price (minimum average variable cost) as the **shutdown point**.

Figure 4: Shutdown and Breakeven

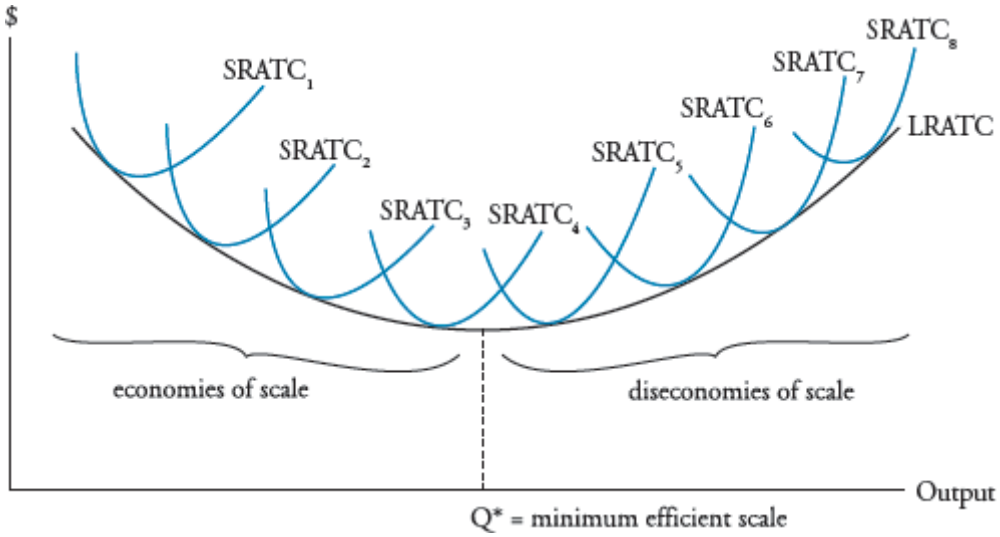


Economies and Diseconomies of Scale

In the long run, firms can adjust their scale of operations (i.e., capital is variable). The minimum average total cost at each possible scale of operations is shown on the **long-run average total cost (LRATC)** curve.

The downward sloping segment of the long-run average total cost curve presented in Figure 5 indicates that **economies of scale** (or *increasing returns to scale*) are present. Economies of scale result from factors such as labor specialization, mass production, and investment in more efficient equipment and technology. In addition, the firm may be able to negotiate lower input prices with suppliers as firm size increases and more resources are purchased. The lowest point on the LRATC curve corresponds to the scale or plant size at which the average total cost of production is at a minimum. This scale is sometimes called the **minimum efficient scale**. At larger firm sizes, minimum average total costs begin to increase, indicating that there are **diseconomies of scale** beyond the minimum efficient scale.

Figure 5: Economies and Diseconomies of Scale



THE FIRM AND MARKET STRUCTURES

We can differentiate among four types of markets based on the following characteristics:

- Number of firms and their relative sizes.
- Elasticity of the demand curves they face.
- Ways that they compete with other firms for sales.
- Ease or difficulty with which firms can enter or exit the market.

At one end of the spectrum is **perfect competition**, in which many firms produce identical products and competition forces them all to sell at the market price. At the other extreme, we have **monopoly**, where only one firm is producing the product. In between are **monopolistic competition** (many sellers and differentiated products) and **oligopoly** (few firms that compete in a variety of ways).

Characteristics of Market Structures

Markets can be differentiated by several characteristics, including number of seller firms, their market shares/industry concentration, the degree of product differentiation, the nature of competition, and barriers to entry into and exit from the industry. We can identify four primary types of market structures. An analyst, however, may be most concerned with the pricing power a particular firm has.

Perfect competition is characterized by:

- Many firms, each small relative to the market.
- Very low barriers to entry into or exit from the industry.
- Homogeneous products that are perfect substitutes.
- No advertising or branding.
- No pricing power.

Monopolistic competition is characterized by:

- Many firms.
- Low barriers to entry into or exit from the industry.
- Differentiated products, heavy advertising, and high marketing expenditure.
- Firms that have some pricing power.

Oligopoly markets are characterized by:

- Few sellers.
- High barriers to entry into or exit from the industry.
- Products that may be homogeneous or differentiated by branding and advertising.
- Firms that may have significant pricing power.

Monopoly is characterized by:

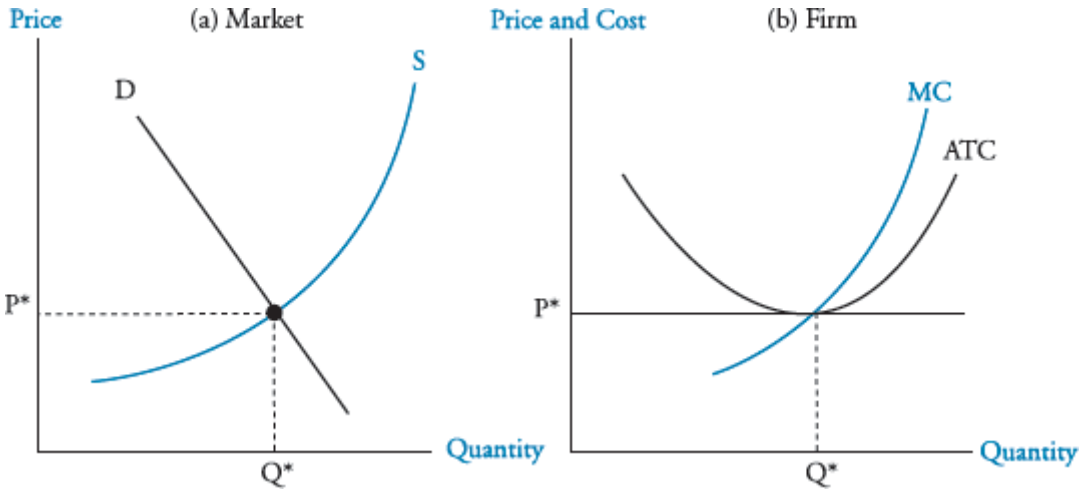
- A single firm that comprises the whole market.
- Very high barriers to enter or exit the industry.
- Advertising used to compete with substitute products.
- Significant pricing power.

Demand Characteristics

Perfect competition:	Price = marginal revenue = marginal cost (in equilibrium)
	Perfectly elastic firm demand curve
	Zero economic profit in equilibrium
Monopolistic competition:	Price > marginal revenue = marginal cost (in equilibrium)
	Downward sloping firm demand curve
	Zero economic profit in long-run equilibrium
Oligopoly:	Price > marginal revenue = marginal cost (in equilibrium)
	Downward sloping firm demand curve
	May have positive economic profit in long-run equilibrium
	Tends towards zero economic profit over time
Monopoly:	Price > marginal revenue = marginal cost (in equilibrium)
	Downward sloping firm demand curve
	May have positive economic profit in long-run equilibrium
	Profits may be zero because of expenditures to preserve monopoly

All firms maximize profits by producing the quantity of output for which marginal cost equals marginal revenue. Under perfect competition (perfectly elastic demand), marginal revenue also equals price. Equilibrium under perfect competition is illustrated in Figure 6.

Figure 6: Equilibrium in a Perfectly Competitive Market



The market price, P*, is determined by the intersection of market supply and demand (Panel a). To maximize profits, each individual firm will produce the quantity for which marginal cost equals marginal revenue. This is the price when firm demand is perfectly

elastic (Panel b). In long-run equilibrium, this is also the quantity for which average total cost is minimized.

An increase in market demand will result in an increase in market price, and each firm will increase output and earn economic profits in the short run. In the long run, these economic profits will attract new firms into the industry, increasing market supply and decreasing the market price until the equilibrium situation illustrated in Figure 6 is restored.

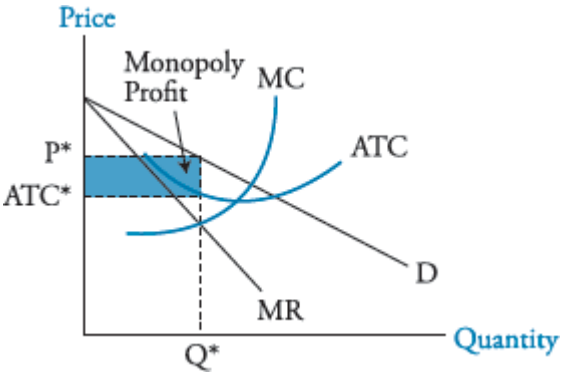
Firms in monopolistic competition or that operate in oligopoly or monopoly markets all face downward sloping demand curves. Selling price is determined from the price on the demand curve for the profit maximizing quantity of output.

An increase (decrease) in demand will increase (decrease) economic profits in the short run under all market structures. Positive economic profits result in entry of firms into the industry unless barriers to entry are high. Negative economic profits result in exit of firms from the industry unless barriers to exit are high. When firms enter (exit) an industry, market supply increases (decreases), resulting in a decrease (increase) in market price and an increase (decrease) in the equilibrium quantity traded in the market.

A **natural monopoly** refers to a situation where the average cost of production is falling over the relevant range of consumer demand. In this case, having two (or more) producers would result in a significantly higher cost of production and be detrimental to consumers.

Left unregulated, a single-price monopolist will maximize profits by producing the quantity for which MR = MC, charge the price indicated on the demand curve for that quantity, and maximize their producers' surplus. This situation is illustrated in Figure 7.

Figure 7: Monopoly Short-Run Costs and Revenues



Government regulation may attempt to improve resource allocation by requiring a monopolist to institute **average cost pricing** or **marginal cost pricing** (with a subsidy to the firm if MC < ATC). Additionally, regulators often attempt to increase competition and efficiency through efforts to reduce artificial barriers to trade, such as licensing requirements, quotas, and tariffs.

Rather than estimate elasticity of demand, **concentration measures** for a market or industry are often used as an indicator of market power. One concentration measure is the **N-firm concentration ratio**, which is calculated as the sum of the percentage market shares of the largest *N* firms in a market. While this measure is simple to calculate and understand, it does not directly measure market power or elasticity of demand.

One limitation of the N-firm concentration ratio is that it may be relatively insensitive to mergers of two firms with large market shares. This problem is reduced by using an alternative measure of market concentration, the **Herfindahl-Hirschman Index (HHI)**. The HHI is calculated as the sum of the squares of the market shares of the largest firms in the market.

A second limitation that applies to both concentration measures is that barriers to entry are not considered. Even a firm with high market share may not have much pricing power if barriers to entry are low and there is *potential competition* in that a competitor may enter the market if the price is high enough to produce economic profits.

There are alternative assumptions made about the nature of competition in oligopoly markets. At one extreme, competition within an oligopoly market is strong, the product undifferentiated, and the result is very much like perfect competition in the long run. At the other extreme, if oligopolistic firms successfully collude (mostly illegally), they will charge the price a monopolist would and agree to share the economic profits. Between these extremes, we have the following models:

The **kinked demand curve model** is based on an assumption that a firm's competitors will not follow a price increase but will cut their prices in response to a price decrease by a competitor. Under this model, each firm faces a demand curve with a kink at the current market price—more elastic above the current price and less elastic below the current price.

The **Cournot model** assumes that the firms in a two-firm oligopoly have identical cost structures and react only to the price charged by the other firm in the prior period. Each firm will produce half the industry output and charge the same price in equilibrium. This is a special case of a **Nash equilibrium**, defined as a situation in which no firm can increase profits by changing its price/output choice. The incentive for firms to cheat on a collusive agreement that is not a Nash equilibrium is one reason that collusive agreements are difficult to maintain.

In the **dominant firm model**, one firm is assumed to have the lowest cost structure and a significant proportion of the market. In this case, the dominant firm essentially sets the price for the industry, and competitors set their output quantities taking this price as given.

Supply Curves and Market Structure

Under perfect competition, a firm's short-run supply curve is the portion of the firm's short-run marginal cost curve above average variable cost. A firm's long-run supply curve is the portion of the firm's long-run marginal cost curve above average total cost.

Firms operating under monopolistic competition, oligopoly, and monopoly do not have well-defined supply functions, so neither marginal cost curves nor average cost curves are supply curves in these cases.

To identify the type of market in which a firm operates, an analyst should focus on the number of firms in the market, their market shares, the nature of competition, the availability of substitute goods, and barriers to entry into and exit from the industry.

AGGREGATE OUTPUT, PRICES, AND ECONOMIC GROWTH

There are alternative methods of calculating gross domestic product (GDP), the market value of all final goods and services produced within a country over a specific time period, usually one year.

Using the **income approach**, GDP is calculated as the total income earned by households and businesses in the country during a time period.

Using the **expenditure approach**, GDP is calculated as the total amount spent on goods and services produced in the country during a time period.

The expenditure approach to measuring GDP can use the **sum-of-value-added method** or the **value-of-final-output method**.

- *Sum-of-value-added*: GDP is calculated by summing the additions to value created at each stage of production and distribution.
- *Value-of-final-output*: GDP is calculated by summing the values of all final goods and services produced during the period.

GDP under all these methods is the same, and estimates using different methods will differ only due to statistical discrepancies.

Nominal GDP values goods and services at their current prices. **Real GDP** measures current-year output using prices from a base year.

The **GDP deflator** is a price index that can be used to convert nominal GDP into real GDP by removing the effects of changes in prices. Price change estimates are based on the ratio of current-year nominal GDP to the value of the current-year output mix using base-year prices.

The four components of gross domestic product are consumption spending, business investment, government spending, and net exports. The relationship among them is:

$$GDP = C + I + G + (X - M)$$

We may also express this equation as:

$$GDP = (C + G^C) + (I + G^I) + (X - M)$$

where:

G^C = government consumption

G^I = government investment (capital goods, inventories)

National income is the income received by all factors of production used in the creation of final output.

Personal income is the pretax income received by households.

Disposable income is personal income after taxes.

Private saving and investment are related to the fiscal balance and the trade balance. A fiscal deficit must be financed by some combination of a trade deficit or an excess of private saving over private investment. We write this relation as:

$$(G - T) = (S - I) - (X - M)$$

From this relation, we can see that a government budget deficit can be offset by a trade deficit or an excess of domestic savings over domestic investment. A government budget deficit combined with a trade surplus ($X - M > 0$) must be offset by a surplus of domestic savings over domestic investment.

The **aggregate demand curve** (AD curve) illustrates the negative relationship between the price level and the level of real output. Points on the AD curve are combinations of the price level and real output for which both the goods market and the money market are in equilibrium.

Three effects explain why the AD curve slopes downward:

- **Wealth effect**. People feel richer with lower prices and increase their consumption of goods and services.
- **Interest rate effect**. Higher interest rates decrease both consumption (especially of goods typically purchased on credit) and investment (because a higher cost of capital reduces the profitability of projects).
- **Real exchange rate effect**. When the domestic price level increases relative to the price level in a foreign country, the real price of the domestic country's goods increases for foreigners, which reduces demand for exports. At the same time, the real price of imports decreases, increasing the quantity of imports demanded. Both reduce net exports and therefore aggregate demand.

The **short-run aggregate supply curve** shows the positive relationship between real GDP supplied and the price level when other factors are held constant. Because we hold some input costs fixed in the short run (e.g., wages), the SRAS curve slopes upward because higher output prices result in greater output (real wages fall).

Because all input prices are assumed to be flexible in the long run, the **long-run aggregate supply curve** is perfectly inelastic (vertical). Long-run aggregate supply represents **potential GDP**, the full-employment level of economic output.

Shifts in the aggregate demand curve are caused by changes in household wealth, business and consumer expectations, capacity utilization, fiscal policy, monetary policy, currency exchange rates, and global economic growth rates.

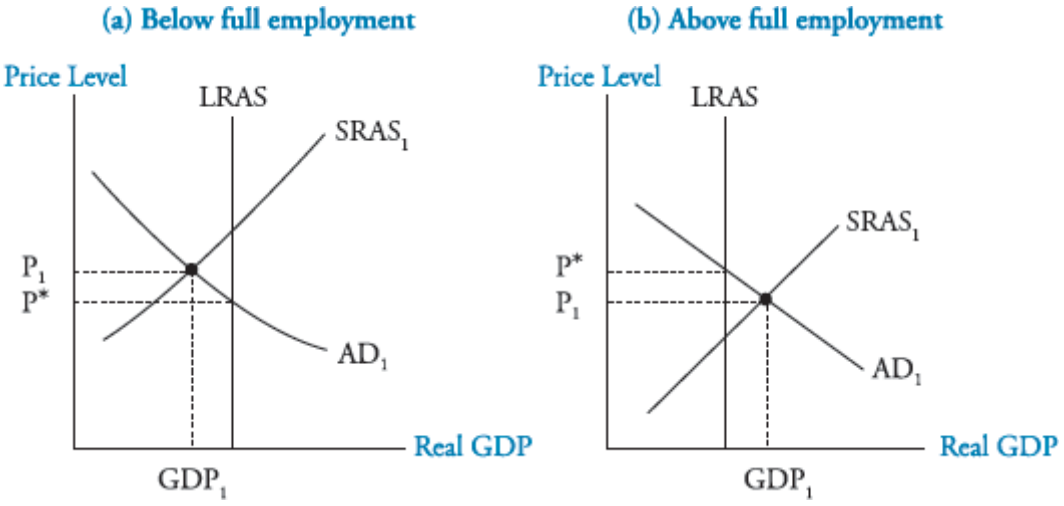
Shifts in the short-run aggregate supply curve are caused by changes in nominal wages or other input prices, expectations of future prices, business taxes, business subsidies, and currency exchange rates, as well as by the factors that affect long-run aggregate supply.

Shifts in the long-run aggregate supply curve are caused by changes in labor supply and quality, the supply of physical capital, the availability of natural resources, and the level of technology.

In Figure 8, we illustrate the situation in the short run when aggregate demand decreases (Panel a) and increases (Panel b). The situation in Panel a when aggregate demand has

decreased is referred to as a **recessionary gap** because real GDP is less than potential real GDP (LRAS). The resulting downward pressure on input prices will result in an increase in SRAS. The SRAS curve will shift to the right as input prices fall until aggregate demand once again equals LRAS.

Figure 8: Long-Run Disequilibrium



In Panel b, we illustrate an increase in aggregate demand that results in an **inflationary gap**. Here real GDP is greater than potential real GDP in the short run, causing upward pressure on input prices. As input prices increase, SRAS decreases and long-run equilibrium is restored as we move along the aggregate demand curve to its intersection with LRAS.

Stagflation is simultaneous high inflation and weak economic growth, which can result from a sudden decrease in short-run aggregate supply.

Sources of economic growth include:

- Increases in the supply of labor.
- Increases in human capital.
- Increases in the supply of physical capital.
- Increases in the availability of natural resources.
- Advances in technology.

The **sustainable rate of economic growth** is determined by the rate of increase in the labor force and the rate of increase in labor productivity.

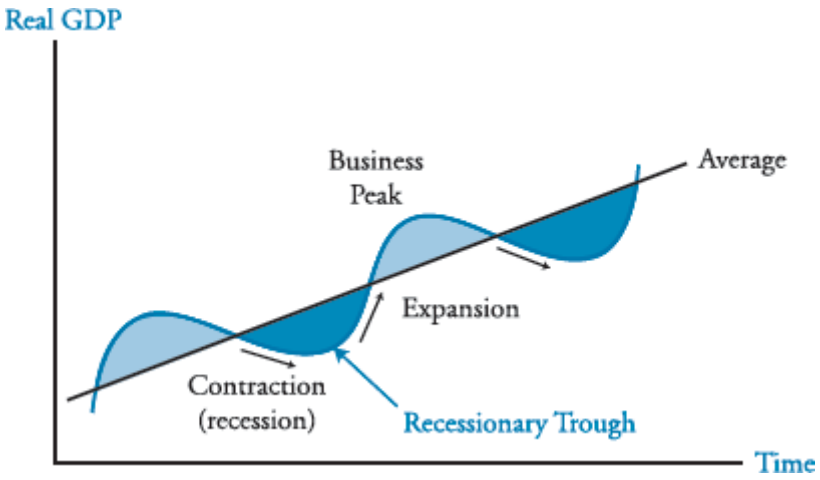
A **production function** relates economic output to the supply of labor, the supply of capital, and total factor productivity. Total factor productivity is a residual factor, which represents that part of economic growth not accounted for by increases in the supply of either labor or capital. Increases in total factor productivity can be attributed to advances in technology.

In developed countries, where a high level of capital per worker is available and capital inputs experience diminishing marginal productivity, technological advances that increase total factor productivity are the main source of sustainable economic growth.

UNDERSTANDING BUSINESS CYCLES

The business cycle has four phases: **expansion** (real GDP is increasing), **peak** (real GDP stops increasing and begins decreasing), **contraction** or **recession** (real GDP is decreasing), and **trough** (real GDP stops decreasing and begins increasing).

Figure 9: Business Cycle



Inventory-to-sales ratios typically increase late in expansions, when sales slow unexpectedly, and decrease near the end of contractions, when sales unexpectedly begin to accelerate. As firm expectations change, firms decrease or increase production to restore their inventory-to-sales ratios to their desired levels.

Because hiring and laying off employees have high costs, firms prefer to adjust their utilization of current employees. As a result, firms are slow to lay off employees early in contractions and slow to add employees early in expansions.

Firms use their physical capital more intensively during expansions, investing in new capacity only if they believe the expansion is likely to continue. They use physical capital less intensively during contractions, but they are more likely to reduce capacity by deferring maintenance and not replacing equipment than by selling their physical capital.

Consumer spending increases during expansions and decreases during contractions. Spending on durable goods is highly cyclical because they are often higher-value purchases and consumers are more willing to purchase them when incomes are increasing and economic confidence is high. Spending on discretionary services is also positively correlated with business cycle phases, while spending on nondurable goods and nondiscretionary services tends to be relatively stable over the business cycle.

Credit Cycles

Credit cycles refer to cyclical fluctuations in interest rates and the availability of loans. Typically, lenders are more willing to lend and to offer lower interest rates during economic expansions; they are less willing to lend and require higher interest rates when the economy is contracting. Historical data suggest credit cycles have been longer in duration on average than business cycles and their fluctuations are more pronounced.

Business Cycle Theories

Neoclassical economists: Business cycles are temporary and driven by changes in technology. Rapid adjustments of wages and other input prices cause the economy to move to full-employment equilibrium.

Keynesian economists: Excessive optimism or pessimism among business managers causes business cycles. Contractions can persist because wages are slow to move downward.

New Keynesians: Input prices other than wages are also slow to move downward.

Monetarists: Inappropriate changes in the rate of money supply growth cause business cycles. Money supply growth should be maintained at a moderate and predictable rate to support the growth of real GDP.

Austrian-school economists: Business cycles are initiated by government intervention that drives interest rates to artificially low levels.

Real business cycle theory: Business cycles result from utility-maximizing actions in response to real economic changes, such as external shocks and changes in technology. Policymakers should not intervene in business cycles.

Leading, Coincident, and Lagging Indicators

Economic indicators are used by analysts to assess the current state of the economy and to provide information about future economic activity. Indicators are classified by how they rise and fall relative to the phases of the business cycle.

- *Leading indicators* have turning points that tend to precede those of the business cycle. Weekly hours in manufacturing, the S&P 500 return, private building permits, initial unemployment claims, and the real M2 money supply are examples of leading indicators.
- *Coincident indicators* have turning points that tend to coincide with those of the business cycle and are used to indicate the current phase of the business cycle. Examples are manufacturing activity, personal income, and number of non-agricultural employees.
- *Lagging indicators* have turning points that tend to occur after those of the business cycle. The bank prime lending rate, inventory-to-sales ratio, average duration of unemployment, and the change in unit labor costs are examples of lagging indicators.

A limitation of using economic indicators to predict business cycles is that their relationships with the business cycle are inexact and can vary over time.

Unemployment

Frictional unemployment results from the time lag necessary to match employees seeking work with employers seeking their skills and is always present as employers expand or contract their businesses and as workers move, are fired, or quit to seek other opportunities.

Structural unemployment is caused by long-run changes in the economy that eliminate some jobs while generating other jobs for which unemployed workers are not qualified, so these workers must learn new skills.

Cyclical unemployment is caused by changes in the general level of economic activity. It is positive when the economy is operating at less than full capacity and negative when an expansion leads to employment temporarily above the full employment level.

A person is considered to be **unemployed** if he is not working *and* actively searching for work. The **labor force** includes all people who are either employed or unemployed. The **unemployment rate** is the percentage of people in the labor force who are unemployed. A person who is employed part time but would prefer to work full time, or is employed at a low-paying job despite being qualified for a significantly higher-paying one, is said to be **underemployed**.

The **participation ratio** (also referred to as the *activity ratio* or *labor force participation rate*) is the percentage of the working-age population who are either employed or actively seeking employment.

Short-term fluctuations in the participation ratio can occur because of changes in the number of **discouraged workers**, those who are available for work but are neither employed nor actively seeking employment. The participation rate tends to increase when the economy expands and decrease during recessions.

The movement of discouraged workers out of and back into the labor force causes the unemployment rate to be a lagging indicator of the business cycle. Early in an expansion when hiring prospects begin to improve, the number of discouraged workers who re-enter the labor force is greater than the number hired immediately. This causes the unemployment rate to increase even though employment is expanding. To gauge the current state of the labor market, analysts should also observe other widely available indicators such as the number of employees on payrolls.

Firms' tendency to be slow to hire or lay off workers at business cycle turning points also causes the unemployment rate to lag the business cycle. The effect can also be seen in data on **productivity**, or output per hour worked. Productivity declines early in contractions as firms are slow to reduce employment and increases early in expansions as firms produce more output but are slow to hire new employees.

Inflation

Inflation is a persistent increase in the price level over time. Inflation erodes the purchasing power of a currency. Inflation favors borrowers at the expense of lenders because when the borrower returns the principal to the lender, it is worth less in terms of goods and services (in real terms) than it was worth when it was borrowed.

Inflation that accelerates out of control is referred to as **hyperinflation**, which can destroy a country's monetary system and bring about social and political upheavals.

The **inflation rate** is the percentage increase in the price level, typically compared to the prior year.

Disinflation refers to an inflation rate that is decreasing over time but remains greater than zero.

A persistently decreasing price level (i.e., a negative inflation rate) is called **deflation**. Deflation is commonly associated with deep recessions.

A **price index** measures the total cost of a specific basket of goods and services relative to its cost in a prior (base) period. The inflation rate is most often calculated as the annual percentage change in a price index. **Core inflation** is calculated by excluding food and energy prices from a price index because of their high short-term volatility.

The most widely followed price index is the **consumer price index (CPI)**, which is based on the purchasing patterns of a typical household. The **GDP deflator** (described earlier) and the **producer** or **wholesale price index** are used as measures of price inflation of goods in process and may give early indications of changes in consumer prices. Analysts can observe sub-indexes of the producer price index for different stages of processing (raw materials, intermediate goods, and finished goods) or for specific industries for indications of emerging price pressure.

A **Laspeyres price index** is based on the cost of a specific basket of goods and services that represents actual consumption in a base period. New goods, quality improvements, and consumers' substitution of lower-priced goods for higher-priced goods over time cause a Laspeyres index to be biased upward.

A **Paasche price index** uses current consumption weights for the basket of goods and services for both periods, thereby reducing substitution bias. A **Fisher price index** is the geometric mean of a Laspeyres index and a Paasche index and is termed a *chained index*.

Cost-push inflation results from a decrease in aggregate supply caused by an increase in the real price of an important factor of production, such as labor or energy. Because wages are the largest cost to businesses, analysts look to the unemployment rate as an indicator of future inflationary pressure. The **non-accelerating inflation rate of unemployment (NAIRU)** represents the unemployment rate below which upward pressure on wages is likely to develop.

Demand-pull inflation results from persistent increases in aggregate demand that increase the price level and temporarily increase economic output above its potential or full-employment level. This could result from expansionary fiscal policy when the economy is already near full employment. Monetarists focus on growth in the money supply in excess of the growth rate of real GDP as a cause of demand-pull inflation. Excessive money supply growth will create excess liquidity, reduce interest rates, and increase aggregate demand, resulting in demand-pull inflation.

Because recent inflation levels affect inflation expectations, which are reflected in input prices (commodity prices and especially wages), inflation can persist even after an economy has fallen into recession. Slow or negative economic growth together with high inflation is termed *stagflation*.

MONETARY AND FISCAL POLICY

Fiscal policy is a government's use of taxation and spending to influence the economy.

Monetary policy deals with determining the quantity of money supplied by the central bank. Both policies aim to achieve economic growth with price level stability, although governments use fiscal policy for social and political reasons as well.

Money is defined as a **medium of exchange**. **Functions of money** include a medium of exchange, a store of value, and a unit of account.

In a **fractional reserve system**, new money created is a multiple of new excess reserves available for lending by banks. The potential multiplier is equal to *the reciprocal of the reserve requirement* and, therefore, is inversely related to the reserve requirement.

Three factors influence **money demand**:

1. Transaction demand, for buying goods and services.
2. Precautionary demand, to meet unforeseen future needs.
3. Speculative demand, to take advantage of investment opportunities.

The **money supply** is determined by central banks with the goal of managing inflation and other economic variables.

The **Fisher effect** states that a nominal interest rate is equal to the real interest rate plus the expected inflation rate.

Central bank roles include:

- Supplying currency, acting as banker to the government and to other banks.
- Regulating and supervising the payments system.
- Acting as a lender of last resort.
- Holding the nation's gold and foreign currency reserves.
- Conducting monetary policy.

Central banks have the objective of controlling inflation. Some central banks have additional goals such as maintaining currency stability, full employment, positive sustainable economic growth, or moderate interest rates.

Policy tools available to central banks:

- Changing the policy rate.
- Changing the reserve requirement.
- Open market operations.

The policy rate is called the *discount rate* in the United States, the *refinancing rate* by the European Central Bank, and the *two-week repo rate* in the United Kingdom. It can be thought of as the rate the central bank charges member banks to borrow reserves.

Decreasing the policy rate, decreasing reserve requirements, and making open market purchases of securities are all expansionary (tend to increase economic growth). Increasing the policy rate, increasing reserve requirements, and making open market sales of securities are all contractionary (reduce economic growth).

Effective central banks exhibit:

- *Independence*: The central bank is free from political interference.
- *Credibility*: The central bank follows through on its stated policy intentions.
- *Transparency*: The central bank makes it clear what economic indicators it uses and reports on the state of those indicators.

An increase in the growth rate of the money supply will decrease nominal and (in the short run) real interest rates, which will increase economic growth. Because lower real interest rates will decrease foreign investment and demand for the domestic currency, an increase in the growth rate of the money supply will cause the domestic currency to depreciate relative to those of the country's trading partners. The depreciation of the domestic currency will increase export demand, further increasing economic growth. In the long run,

the increase in the money supply will not decrease real interest rates because inflation (and inflation expectations) will increase, offsetting the decrease in nominal interest rates. A decrease in the growth rate of the money supply will have opposite effects.

The **real trend rate** is the long-term sustainable real growth rate of an economy. The **neutral interest rate** is the sum of the real trend rate and the target inflation rate. Monetary policy is said to be contractionary when the policy rate is above the neutral rate and expansionary when the policy rate is below the neutral rate.

Reasons that monetary policy may not work as intended:

- Monetary policy changes may affect inflation expectations to such an extent that long-term interest rates move opposite to short-term interest rates.
- Individuals may be willing to hold greater cash balances without a change in short-term rates so that an expansion of the money supply does not reduce short-term rates (liquidity trap).
- Banks may be unwilling to lend greater amounts, even when they have more excess reserves as a result of an increase in the money supply.
- Short-term rates cannot be reduced below zero.
- Developing economies face unique challenges in utilizing monetary policy due to undeveloped financial markets, rapid financial innovation, and lack of credibility of the monetary authority.

Fiscal policy refers to the taxing and spending policies of the government. Objectives of fiscal policy can include:

- Influencing the level of economic activity.
- Redistributing wealth or income.
- Allocating resources among industries.

Fiscal policy is implemented by governmental changes in taxing and spending policies.

A government has a *budget surplus* when tax revenues exceed government spending and a *budget deficit* when spending exceeds tax revenue.

Fiscal policy tools include spending tools and revenue tools. Spending tools include transfer payments, current spending (goods and services used by government), and capital spending (investment projects funded by government). Revenue tools include direct and indirect taxation.

An increase (decrease) in a government budget surplus is indicative of a contractionary (expansionary) fiscal policy. Similarly, an increase (decrease) in a government budget deficit is indicative of an expansionary (contractionary) fiscal policy.

An *advantage of fiscal policy* is that indirect taxes (sales, value-added, and excise taxes) can be used to quickly implement social policies and can also be used to quickly raise revenues at a low cost.

Disadvantages of fiscal policy include time lags for implementing changes in direct taxes and time lags for capital spending changes to have an impact. Delays (lags) in realizing the effects of fiscal policy changes limit their usefulness.

Types of lags:

- **Recognition lag:** Policymakers may not immediately recognize when fiscal policy changes are needed.
- **Action lag:** Governments take time to enact needed fiscal policy changes.
- **Impact lag:** Fiscal policy changes take time to affect economic activity.

Arguments for being concerned with the size of fiscal deficit:

- Higher future taxes lead to disincentives to work, negatively affecting long-term economic growth.
- Fiscal deficits might not be financed by the market when debt levels are high.
- A *crowding-out effect* as government borrowing increases interest rates and decreases private sector investment.

Arguments against being concerned with the size of fiscal deficit:

- Debt may be financed by domestic citizens.
- Deficits for capital spending can boost the productive capacity of the economy.
- Fiscal deficits may prompt needed tax reform.
- *Ricardian equivalence* may prevail: private savings rise in anticipation of the need to repay principal on government debt.
- When the economy is operating below full employment, deficits do not crowd out private investment.

Monetary and fiscal policy will interact, and when one is expansionary and the other is contractionary, they will offset to some degree. The following table summarizes the effects for different combinations of fiscal and monetary policy.

Monetary Policy	Fiscal Policy	Interest Rates	Output	Private Sector Spending	Public Sector Spending
Tight	Tight	higher	lower	lower	lower
Easy	Easy	lower	higher	higher	higher
Tight	Easy	higher	higher	lower	higher
Easy	Tight	lower	varies	higher	lower

INTRODUCTION TO GEOPOLITICS

Geopolitics refers to interactions among nations, including the actions of **state actors** (national governments) and **non-state actors** (corporations, nongovernment organizations, and individuals). Originally, geopolitics referred to the study of how geography affects interactions among nations.

Countries' actions range from cooperative to noncooperative with regard to diplomatic, military, economic, and cultural matters. Examples of economic cooperation include freedom of movement for goods, services, and capital; harmonizing tariffs; and standardizing rules.

Globalization refers to worldwide integration of economic activity and cultures. We may contrast globalization with **nationalism**, which in this context refers to a nation pursuing its

own interests independently of or in competition with other countries. In general, countries that pursue globalization actively import and export goods and services, permit free movement of capital and exchange of currencies, and are open to cultural interaction.

Autarky (noncooperation and nationalism) refers to a goal of national self-reliance and is often associated with a state-dominated society in general.

Hegemony (noncooperation and globalization) refers to countries that are open to globalization but can influence other countries without necessarily cooperating.

Bilateralism (cooperation and nationalism) refers to cooperation between two countries; a country may have many such relationships but not participate in multicountry arrangements.

Multilateralism (cooperation and globalization) refers to countries that engage extensively in international trade and other forms of cooperation. Some countries may exhibit **regionalism**, cooperating multilaterally with nearby countries but less so with the world at large.

Countries may use national security, economic, or financial tools to advance their geopolitical interests. **National security tools** may include armed conflict, espionage, or bilateral or multilateral agreements designed to reinforce or prevent armed conflict. **Economic tools** can be cooperative (e.g., free trade areas, common markets, and economic and monetary unions) or noncooperative (e.g., domestic content requirements, voluntary export restraints). **Financial tools** include foreign investment and the exchange of currencies.

Geopolitical Risk

Geopolitical risk refers to interruptions of peaceful international relations. **Event risk** refers to events about which we know the timing but not the outcome, such as national elections. **Exogenous risk** refers to unanticipated events, such as outbreaks of war. **Thematic risk** refers to known factors that have effects over long periods, such as human migration patterns. Geopolitical risk affects the risk premium investors require to hold assets in a country or region.

The **likelihood of geopolitical risk** refers to its probability. Countries that are more cooperative and globalized tend to have less likelihood of some geopolitical risks, such as war, but may have greater likelihood of other risks, such as supply chain disruptions.

The **velocity of geopolitical risk** refers to how quickly investment values reflect its effects.

The **impact of geopolitical risk** refers to the magnitude of its effects on investment outcomes.

INTERNATIONAL TRADE AND CAPITAL FLOWS

Gross domestic product (GDP) is the total value of goods and services produced within a country's borders over a period. **Gross national product** (GNP) is the total value of goods and services produced by the labor and capital of a country's citizens. Income of a country's citizens working abroad is included in its GNP but not in its GDP. Income to capital in the domestic country that is owned by foreigners is included in the domestic

country's GDP but not in its GNP. GDP is more closely related to economic activity within a country's borders.

A country is said to have an **absolute advantage** in the production of a good if it can produce the good at a lower cost, in terms of resources, than another country.

A country is said to have a **comparative advantage** in the production of a good if its opportunity cost, in terms of other goods that could be produced instead, is lower than that of another country. The opportunity cost of producing a unit of one good is the number of units of another good that could be produced instead.

Regardless of absolute advantage, if the opportunity costs of producing two goods are different between two countries, trading will allow each country to specialize in production of the good in which it has a comparative advantage, resulting in greater overall production of both goods and increased economic welfare. The costs of trade are primarily those imposed on workers and firms in industries that face competition from lower-cost imported goods.

Assume England and Portugal can produce the following amounts of cloth and wine with a day of labor:

	Yards of Cloth	Bottles of Wine
Portugal	100	110
England	90	80

The opportunity cost of a yard of cloth in Portugal is 110 / 100 = 1.1 bottles of wine. In England, the opportunity cost of one yard of cloth is 80 / 90 = 0.89 bottles of wine.

Portugal has an absolute advantage in producing both goods, but England has a comparative advantage in the production of cloth (cost is 0.89 bottles of wine versus 1.1 bottles of wine for Portugal). Portugal must therefore have a comparative advantage in producing wine.

The **Ricardian model of trade** has only one factor of production—labor. The source of comparative advantage in Ricardo's model is *differences in labor productivity* due to differences in technology.

Heckscher and Ohlin presented a model in which there are two factors of production—capital and labor. The source of comparative advantage (differences in opportunity costs) in this model is *differences in the relative amounts of each factor* the countries possess. The country that has more capital will specialize in the capital intensive good and trade for the less capital intensive good with the country that has relatively more labor and less capital. In the **Heckscher-Ohlin model**, there is a redistribution of wealth within each country between labor and the owners of capital. The price of the relatively less scarce (more available) factor of production in each country will increase so that its owners will earn more compared to what they would earn without trade.

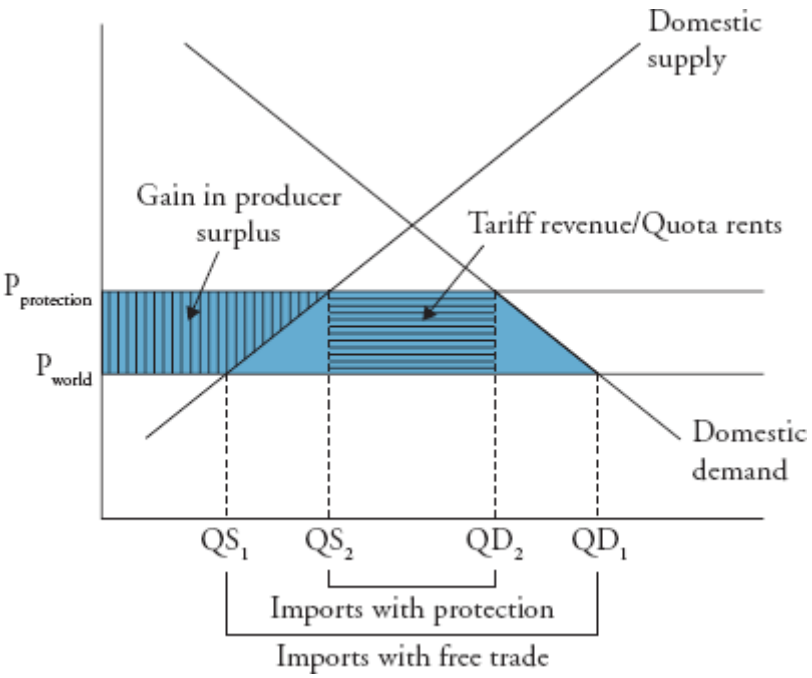
Types of Trade Restrictions

- **Tariffs:** Taxes on imported goods collected by the government.
- **Quotas:** Limits on the amount of imports allowed over some period.

- **Export subsidies:** Government payments to firms that export goods.
- **Minimum domestic content:** Requirement that some percentage of product content must be from the domestic country.
- **Voluntary export restraint:** A country voluntarily restricts the amount of a good that can be exported, often in the hope of avoiding tariffs or quotas imposed by their trading partners.

In general, all trade restrictions make foreign producers worse off, domestic producers and industry workers better off, and domestic consumers worse off. In Figure 10, note that prior to the imposition of a quota or tariff, the total quantity demanded domestically is QD_1, and QS_1 is supplied by domestic suppliers at price P_{World}. The imposition of the tariff raises the price on imports to $P_{Protection}$, the quantity demanded decreases to QD_2, the quantity supplied by domestic producers increases to QS_2, and the quantity of imports decreases. The result is an increase in the domestic price of the good and a loss of consumer surplus equal to the blue-shaded area. The portion with vertical lines is an increase in domestic producers' surplus, the portion with horizontal lines is the total tariff revenue collected by the government, and the other two areas represent a deadweight loss.

Figure 10: Effects of Tariffs and Quotas



Some countries impose **capital restrictions** on the flow of financial capital across borders. Restrictions include:

- Outright prohibition of investment in the domestic country by foreigners.
- Prohibition of or taxes on the income earned on foreign investments by domestic citizens.
- Prohibition of foreign investment in certain domestic industries.
- Restrictions on repatriation of earnings of foreign entities operating in a country.

Overall, capital restrictions are thought to decrease economic welfare, but they do protect developing countries from large swings in asset prices as foreign capital moves into and out

of a particular country.

Trade agreements can be categorized by the degree of economic integration among the participants. Each type of agreement in the following list includes the provisions in the previous type of agreement, so that monetary union is the most integrated and includes all the provisions listed.

- **Free trade area:** All barriers to import and export of goods and services among member countries are removed.
- **Customs union:** In addition, all member countries adopt a common set of trade restrictions with non-members.
- **Common market:** In addition, all barriers to the movement of labor and capital goods among member countries are removed.
- **Economic union:** In addition, member countries establish common institutions and economic policy.
- **Monetary union:** In addition, member countries adopt a single currency.

Balance of Payments Accounts

According to the U.S. Federal Reserve, "The BOP [**balance of payments**] includes the **current account**, which mainly measures the flows of goods and services; the **capital account**, which consists of capital transfers and the acquisition and disposal of non-produced, nonfinancial assets; and the **financial account**, which records investment flows."

The **current account** comprises three sub-accounts:

- Merchandise and services.
- Income receipts, including foreign income from dividends on stock holdings and interest on debt securities.
- Unilateral transfers, which are one-way transfers of assets.

The **capital account** comprises two sub-accounts:

- Capital transfers.
- Sales and purchases of nonfinancial assets.

The **financial account** comprises two sub-accounts:

- Government-owned assets abroad.
- Foreign-owned assets in the domestic country.

A country that has imports valued more than its exports is said to have a **current account (trade) deficit**, while countries with more exports than imports are said to have a **current account surplus**. For a country with a trade deficit, it must be balanced by a net surplus in the capital and financial accounts. As a result, investment analysts often think of all financing flows as a single "capital" account that combines items in the capital and financial accounts. Thinking in this way, any deficit in the current account must be made up by a surplus in the (combined) capital account.

In equilibrium, we have the relationship:

$$\text{exports} - \text{imports} = \text{private savings} + \underset{\text{savings}}{\text{government}} - \underset{\text{investment}}{\text{domestic}}$$

When total savings is less than domestic investment, imports must be greater than exports so that there is a deficit in the current account. Lower levels of private saving, larger government deficits, and high rates of domestic investment all tend to result in or increase a current account deficit. The intuition here is that low private or government savings in relation to private investment in domestic capital requires foreign investment in domestic capital.

The **International Monetary Fund (IMF)** facilitates trade by promoting international monetary cooperation and exchange rate stability, assists in setting up international payments systems, and makes resources available to member countries with balance of payments problems.

The **World Bank** provides low-interest loans, interest-free credits, and grants to developing countries for many specific purposes. It also provides resources and knowledge and helps form private/public partnerships with the overall goal of fighting poverty.

The **World Trade Organization (WTO)** has the goal of ensuring that trade flows freely and works smoothly. Their main focus is on instituting, interpreting, and enforcing a number of multilateral trade agreements, which detail global trade policies for a large majority of the world's trading nations.

CURRENCY EXCHANGE RATES

At a point in time, the **nominal exchange rate** $1.416/euro suggests that in order to purchase one euro's worth of goods and services in Euroland, the cost in U.S. dollars will be $1.416. We sometimes refer to the numerator currency as the **price currency** and the denominator currency as the **base currency**. In the case of an exchange rate quote of 1.416 USD/EUR, the U.S. dollar is the price currency (expresses the price of one euro) and the euro is the base currency (easy to remember because it is in the bottom or base of the quote).

As time passes, the **real exchange rate** tells us the dollar cost of purchasing that same unit of goods and services based on the new (current) dollar/euro exchange rate and the relative changes in the price levels of both countries. The formula for this calculation is:

$$\text{real exchange rate} = \text{nominal exchange rate} \times \left(\frac{\text{base currency CPI}}{\text{price currency CPI}}\right)$$

If inflation rates in two countries are equal over a period, the real exchange rate is simply the nominal exchange rate at the end of the period. If the inflation rate in country A is greater (less) than the inflation rate in country B, the real exchange rate (with country A's currency as the price currency) will be lower (higher) than the end-of-period nominal exchange rate.

A **spot exchange rate** is the currency exchange rate for immediate delivery.

A **forward exchange rate** is a currency exchange rate for an exchange to be done in the future. Forward rates are quoted for various future dates (e.g., 30 days, 60 days, 90 days,

or one year). A forward is actually an agreement to exchange a specific amount of one currency for a specific amount of another on a future date specified in the forward agreement.

The market for foreign exchange is the largest financial market in terms of the value of daily transactions and has a variety of participants, including large multinational banks (the sell side) and corporations, investment fund managers, hedge fund managers, investors, governments, and central banks (the buy side).

Participants in the foreign exchange markets are referred to as *hedgers* if they enter into transactions that decrease an existing foreign exchange risk and as *speculators* if they enter into transactions that increase their foreign exchange risk.

For a change in an exchange rate, we can calculate the **percentage appreciation or depreciation** of the *base currency*. For example, a decrease in the USD/EUR exchange rate from 1.44 to 1.42 represents a depreciation of the EUR relative to the USD of 1.39% (1.42 / 1.44 − 1 = –0.0139) because the USD price of a euro has gone down.

To calculate the appreciation or depreciation of the USD (relative to the euro), we first convert the quotes to EUR/USD (making the USD the base currency) and then proceed as above. The initial rate becomes 1/1.44 = 0.6944 EUR/USD, and the later rate becomes 1/1.42 = 0.7042 EUR/USD. The change in the exchange value of the dollar (now the base currency) is 0.7042/0.6944 − 1 = +0.0141, so the USD has appreciated 1.41% relative to the euro over the period.

Given two exchange rate quotes for three different currencies, we can calculate a **currency cross rate**. If the MXN/USD quote is 12.1 and the USD/EUR quote is 1.42, we can calculate the MXN/EUR cross rate as 12.1 × 1.42 = 17.18. That is, a euro is priced at 17.18 Mexican pesos.

Points in a foreign currency quotation are in units of the last digit of the quotation. For example, a forward quote of +25.3 when the USD/EUR spot exchange rate is 1.4158 means that the forward exchange rate is 1.4158 + 0.00253 = 1.41833 USD/EUR.

For a forward exchange rate quote given as a percentage, the percentage change in the spot rate is calculated as forward / spot − 1. A forward exchange rate quote of +1.787%, when the spot USD/EUR exchange rate is 1.4158, means that the forward exchange rate is 1.4158 (1 + 0.01787) = 1.4411 USD/EUR.

The percentage difference between the spot exchange rate and the forward exchange rate, expressed as price/base values, is approximately equal to the interest rate (i) for the base currency minus the interest rate for the price currency over the forward period. The exact relationship is:

$$\frac{\text{Forward}}{\text{Spot}} = \frac{1 + i_{\text{Price Currency}}}{1 + i_{\text{Base Currency}}} \text{ so that Forward} = \text{Spot} \times \frac{1 + i_{\text{Price Currency}}}{1 + i_{\text{Base Currency}}}$$

Exchange rate regimes for countries that do not have their own currency:

- With *formal dollarization*, a country uses the currency of another country.
- In a *monetary union*, several countries use a common currency.

Exchange rate regimes for countries that have their own currency:

- A *currency board arrangement* is an explicit commitment to exchange domestic currency for a specified foreign currency at a fixed exchange rate.
- In a *conventional fixed peg arrangement*, a country pegs its currency within margins of ±1% versus another currency.
- In a system of *pegged exchange rates within horizontal bands* or a *target zone*, the permitted fluctuations in currency value relative to another currency or basket of currencies are wider (e.g., ±2 %).
- With a *crawling peg*, the exchange rate is adjusted periodically, typically to adjust for higher inflation versus the currency used in the peg.
- With *management of exchange rates within crawling bands*, the width of the bands that identify permissible exchange rates is increased over time.
- With a system of *managed floating exchange rates*, the monetary authority attempts to influence the exchange rate in response to specific indicators, such as the balance of payments, inflation rates, or employment without any specific target exchange rate.
- When a currency is *independently floating*, the exchange rate is market-determined.

The effect of a depreciation of the domestic currency on a country's trade balance can be analyzed using either the **elasticities approach** or the **absorption approach**.

Under the *elasticities approach*, for a depreciation of the domestic currency to reduce an existing trade deficit, the elasticities (ε) of export and import demand must meet the **Marshall-Lerner condition**:

$$W_{Exports}\,\varepsilon_{Exports} + W_{Imports}\,(\varepsilon_{Imports} - 1) > 0$$

where:

ε = elasticity

W = the proportion of total trade for imports or exports

For situations where a country does not have a trade deficit or surplus, this condition simplifies to $\varepsilon_{Exports} + \varepsilon_{Imports} > 1$.

Under the *absorption approach*, national income must increase relative to national expenditure in order to decrease a trade deficit. This can also be viewed as a requirement that national saving must increase relative to domestic investment in order to decrease a trade deficit.

The **J-curve effect** refers to the fact that a depreciation of the domestic currency may increase a trade deficit in the short run (because of existing foreign-currency-priced export contracts) even though it will eventually reduce the trade deficit.

FINANCIAL STATEMENT ANALYSIS

Weight on Exam	13% to 17%
SchweserNotes™ Reference	Book 2, Pages 1–292

INTRODUCTION TO FINANCIAL STATEMENT ANALYSIS

The **income statement** reports on the financial performance of the firm over a period of time. The elements of the income statement include revenues, expenses, gains, and losses.

- *Revenues* are inflows from delivering or producing goods, rendering services, or other activities that constitute the entity's ongoing major or central operations.
- *Expenses* are outflows from delivering or producing goods or services that constitute the entity's ongoing major or central operations.
- *Gains and losses* are increases (decreases) in equity or net assets from peripheral or incidental transactions.

The **balance sheet** reports the firm's financial position at a point in time. The balance sheet consists of three elements:

1. *Assets* are probable current and future economic benefits obtained or controlled by a particular entity as a result of past transactions or events.
2. *Liabilities* are probable future sacrifices of economic benefits. They arise from present obligations of a particular entity to transfer assets or provide services to other entities in the future as a result of past transactions or events.
3. *Owners' equity* is the residual interest in the assets of an entity that remains after deducting its liabilities from its assets.

Transactions are measured so that the fundamental accounting equation holds:

$$\text{assets} = \text{liabilities} + \text{owners' equity}$$

The **cash flow statement** reports the company's cash receipts and outflows. These cash flows are classified as follows:

- *Operating cash flows* include the cash effects of transactions that involve the normal business of the firm.
- *Investing cash flows* are those resulting from acquisition or sale of property, plant, and equipment, of a subsidiary or segment, and purchase or sale of investments in other firms.
- *Financing cash flows* are those resulting from issuance or retirement of debt and equity securities and dividends paid to stockholders.

The **statement of changes in owners' equity** reports the amounts and sources of changes in equity investors' investment in the firm.

Financial statement notes (footnotes) include disclosures that offer further detail about the information summarized in the financial statements. Footnotes allow users to improve their assessments of the amount, timing, and uncertainty of the estimates reported in the financial statements. Footnotes:

- Provide information about accounting methods and the assumptions and estimates used by management.
- Are audited, whereas other disclosures, such as supplementary schedules, are not audited.
- Provide additional information on such items as fixed assets, inventory, income taxes, pensions, debt, contingencies and commitments, marketable securities, significant customers, sales to related parties, and export sales.
- Often contain disclosures relating to contingent losses.

Supplementary schedules contain additional information. Examples of such disclosures are:

- Operating income or sales by region or business segment.
- Reserves for an oil and gas company.
- Information about hedging activities and financial instruments.

Management's commentary, or **management's discussion and analysis (MD&A)**, provides an assessment of the financial performance and condition of a company from the perspective of its management. For publicly held companies in the United States, the MD&A is required to discuss:

- Trends, significant events, and uncertainties that affect the firm.
- Effects of inflation and changing prices, if material.
- Impact of off-balance-sheet and contractual obligations.
- Accounting policies that require significant judgment by management.
- Forward-looking expenditures and divestitures.

Audit Reports

An **audit** is an independent review of an entity's financial statements. Public accountants conduct audits and examine the financial reports and supporting records. The objective of an audit is to enable the auditor to provide an opinion on the fairness and reliability of the financial reports.

The independent certified public accountant employed by the board of directors is responsible for seeing that the financial statements conform to Generally Accepted Accounting Principles (GAAP). The auditor examines the company's accounting and internal control systems, confirms assets and liabilities, and generally tries to be confident that there are no material errors in the financial statements and that they conform to applicable reporting standards. The auditor's report is an important source of information.

The **standard auditor's opinion** contains three parts, stating that:

1. Whereas the financial statements are prepared by management and are its responsibility, the auditor has performed an independent review.
2. Generally accepted auditing standards were followed, thus providing *reasonable assurance* that the financial statements contain no material errors.
3. The auditor is satisfied that the statements were prepared in accordance with GAAP and that the accounting principles chosen and estimates made are reasonable. The auditor's report must also contain additional explanation when accounting methods have not been used consistently between periods.

An *unqualified opinion* (also known as an unmodified or clean opinion) indicates that the auditor believes the statements are free from material omissions and errors. If the statements make any exceptions to GAAP, the auditor may issue a *qualified opinion* and explain these exceptions in the audit report. The auditor can issue an *adverse opinion* if the statements are not presented fairly or are materially nonconforming with GAAP, or a *disclaimer of opinion* if the auditor is unable to express an opinion. Any opinion other than unqualified is sometimes referred to as a *modified opinion*.

The auditor's opinion will also contain an explanatory paragraph when a material loss is probable but the amount cannot be reasonably estimated. These "uncertainties" may relate to the *going concern assumption* (financial statements assume the firm will continue to operate), the valuation or realization of assets, or to litigation. This type of disclosure may be a signal of serious problems and call for closer examination by the analyst. An audit report must also include a section called Key Audit Matters (international reports) or Critical Audit Matters (U.S.), which highlights accounting choices that are of greatest significance to users of financial statements.

Under U.S. GAAP, the auditor must state an opinion on the company's **internal controls**, the processes by which the company ensures that it presents accurate financial statements. Internal controls are the responsibility of the firm's management. Under the Sarbanes-Oxley Act, management is required to provide a report on the company's internal control system.

An analyst should examine a company's *quarterly or semiannual reports* which typically update the major financial statements and footnotes, but are not necessarily audited.

Other Information Sources

Securities and Exchange Commission filings are available from EDGAR (Electronic Data Gathering, Analysis, and Retrieval System, *www.sec.gov*). These include Form 8-K, which a company must file to report events, such as acquisitions and disposals of major assets, or changes in its management or corporate governance. Companies' annual and quarterly financial statements are also filed with the SEC (Form 10-K and Form 10-Q respectively).

Proxy statements are issued to shareholders when there are matters that require a shareholder vote. These statements, which are also filed with the SEC and available from EDGAR, are a good source of information about the election of (and qualifications of) board members, compensation, management qualifications, and the issuance of stock options.

Corporate reports and press releases are written by management and are often viewed as public relations or sales materials. Not all of the material is independently reviewed by outside auditors. Such information can often be found on the company's Web site. Management may also provide **earnings guidance** to analysts before releasing the firm's financial statements.

An analyst should review information on the economy and the company's industry and compare the company to its competitors. This information can be acquired from sources such as trade journals, statistical reporting services, and government agencies.

The **financial statement analysis framework**[1] consists of six steps:

1. State the objective and context.
2. Gather data.
3. Process the data.
4. Analyze and interpret the data.
5. Report the conclusions or recommendations.
6. Update the analysis.

FINANCIAL REPORTING STANDARDS

Given the variety and complexity of possible transactions, and the estimates and assumptions a firm must make when presenting its performance, financial statements could potentially take any form if reporting standards didn't exist. Reporting standards ensure that the information is useful to a wide range of users, including security analysts, the firm's creditors, and current and potential investors, by making financial statements comparable to one another and narrowing the range within which management's estimates can be seen as reasonable.

Standard-setting bodies are professional organizations of accountants and auditors that establish financial reporting standards. **Regulatory authorities** are government agencies that have the legal authority to enforce compliance with financial reporting standards.

The two primary standard-setting bodies are the *Financial Accounting Standards Board* (FASB) and the *International Accounting Standards Board* (IASB). In the United States, the FASB sets forth Generally Accepted Accounting Principles (U.S. GAAP). Outside the United States, the IASB establishes International Financial Reporting Standards (IFRS).

Regulatory authorities, such as the *Securities and Exchange Commission* in the United States and the *Financial Conduct Authority* in the United Kingdom, are established by national governments to enforce accounting standards.

Most national authorities belong to the *International Organization of Securities Commissions* (IOSCO). Because of the increasing globalization of securities markets, IOSCO is seeking to attain uniform financial regulations across countries.

Qualitative Characteristics

The two fundamental characteristics that make financial information useful are **relevance** and **faithful representation**.[2]

- Financial statements are relevant if they contain information that can influence economic decisions or affect evaluations of past events or forecasts of future events.
- Information that is faithfully representative is complete, neutral (absence of bias), and free from error.

Four characteristics enhance relevance and faithful representation: comparability, verifiability, timeliness, and understandability.

- *Comparability*. Financial statement presentation should be consistent among firms and across time periods.
- *Verifiability*. Independent observers, using the same methods, obtain similar results.
- *Timeliness*. Information is available to decision makers before the information is stale.
- *Understandability*. Users with basic business knowledge should be able to understand the statements.

Constraints and Assumptions

One of the constraints on financial statement preparation is the need to balance reliability, in the sense of being free of error, with the timeliness that makes the information relevant. Cost is also a constraint; the benefit that users gain from the information should be greater than the cost of presenting it. A third constraint is the fact that intangible and non-quantifiable information cannot be captured directly in financial statements.

The two primary assumptions that underlie financial statements are the accrual basis and the going concern assumption. The accrual basis requires that revenue be recognized when earned and expenses recognized when incurred, regardless of when cash is actually paid. The going concern assumption presumes that the company will continue to operate for the foreseeable future.

Required Financial Statements

The *required financial statements* are as follows:

- Balance sheet.
- Statement of comprehensive income.
- Cash flow statement.
- Statement of changes in owners' equity.
- Explanatory notes, including a summary of accounting policies.

The general **features for preparing financial statements** are stated in IAS No. 1:

- *Fair presentation*, faithfully representing the effects of the entity's transactions and events.
- *Going concern basis*, assuming that the firm will continue to exist unless its management intends to (or must) liquidate it.
- *Accrual basis* of accounting is used to prepare the financial statements other than the statement of cash flows.
- *Consistency* between periods in how items are presented and classified.

- *Materiality*, meaning the financial statements should be free of misstatements or significant omissions.
- *Aggregation* of similar items and separation of dissimilar items.
- *No offsetting* of assets against liabilities or income against expenses unless a specific standard permits or requires it.
- *Reporting frequency* must be at least annually.
- *Comparative information* for prior periods should be included unless a specific standard states otherwise.

IAS No. 1 also states that most entities should present a *classified balance sheet* showing current and noncurrent assets and liabilities and describes the minimum information that is required on the face of each financial statement and in the notes.

As financial reporting standards continue to evolve, analysts need to monitor how these developments will affect the financial statements they use. An analyst should be aware of new products and innovations in the financial markets that generate new types of transactions. These might not fall neatly into the existing financial reporting standards.

To keep up to date on the evolving standards, an analyst can monitor professional journals and other sources, such as the IASB and FASB websites. CFA Institute produces position papers on financial reporting issues through the CFA Centre for Financial Market Integrity.

UNDERSTANDING INCOME STATEMENTS

The income statement reports the revenues and expenses of the firm for a period of time. The income statement is sometimes referred to as the “statement of operations,” the “statement of earnings,” or the “profit and loss statement (P&L).”

The income statement equation is:

> $$\text{revenues} - \text{expenses} = \text{net income}$$

Revenues are the amounts reported from the sale of goods and services in the normal course of business. **Expenses** are the amounts incurred to generate revenue, such as cost of goods sold, operating expenses, interest, and taxes. Expenses are grouped together by their nature or function.

The income statement also includes **gains and losses**, which result from incidental transactions outside the firm’s normal business activities.

Presentation Formats

A firm can present its income statement using a single-step or multi-step format. In a single-step statement, all revenues are grouped together and all expenses are grouped together. A multi-step format includes subtotals such as gross profit and operating profit.

Gross profit is the amount that remains once the cost of a product or service is subtracted from revenue. Subtracting operating expenses, such as selling, general and administrative expenses, from gross profit results in another subtotal known as **operating profit** or operating income.

For *nonfinancial firms*, operating profit is the amount that remains before financing costs and income taxes are considered. Subtracting interest expense and income taxes from operating profit results in the firm's **net income**, sometimes referred to as "earnings" or the "bottom line." For *financial firms*, interest expense is usually considered an operating expense.

When a firm has a controlling interest in a subsidiary, the statements of the two firms are *consolidated*; the earnings of both firms are included on the income statement. In this case, the share of the subsidiary's income that the firm does not own is reported in the firm's income statement as **noncontrolling interest** or **minority owners' interest**.

Revenue Recognition

In a sale where the goods are exchanged for cash and returns are not allowed, the recognition of revenue is straightforward: it is recognized at the time of the exchange. The recognition of revenue is not, however, dependent on receiving cash payment. If a sale of goods is made on credit, revenue can be recognized at the time of sale, and an asset, **accounts receivable**, is created on the balance sheet.

If payment for the goods is received prior to the transfer of the good, a liability, **unearned revenue**, is created when the cash is received (offsetting the increase in the asset *cash*). Revenue is recognized as the goods are transferred to the buyer. As an example, consider a magazine subscription. When the subscription is purchased, an unearned revenue liability is created, and as magazine issues are delivered, revenue is recorded and the liability is decreased.

In May 2014, IASB and FASB issued principles-based standards for revenue recognition that took effect at the beginning of 2018. The central principle is that a firm should recognize revenue when it has transferred a good or service to a customer.

The converged standards identify a five-step process for recognizing revenue:

1. Identify the contract(s) with a customer.
2. Identify the separate or distinct performance obligations in the contract.
3. Determine the transaction price.
4. Allocate the transaction price to the performance obligations in the contract.
5. Recognize revenue when (or as) the entity satisfies a performance obligation.

A **performance obligation** is a promise to deliver a distinct good or service. A **transaction price** is the amount a firm expects to receive from a customer in exchange for transferring a good or service.

For long-term contracts, revenue is recognized based on a firm's progress toward completing a performance obligation. Progress towards completion can be measured from the input side (e.g., using the percentage of completion costs incurred), or from the output side (e.g., using the percentage of the total output delivered to date).

Expense Recognition

Under the accrual method of accounting, expense recognition is based on the *matching principle*, whereby expenses for producing goods and services are recognized in the period in which the revenue for the goods and services is recognized. Expenses that are not tied directly to generating revenue, such as administrative costs, are called *period costs* and are expensed in the period incurred.

The cost of long-lived assets must also be matched with revenues. The allocation of cost over an asset's useful life is known as **depreciation** or **amortization** expense.

If a firm sells goods or services on credit or provides a warranty to the customer, the matching principle requires the firm to estimate bad-debt expense and/or warranty expense. Since estimates are involved, it is possible for firms to delay the recognition of expense. Delayed expense recognition increases net income and is, therefore, more aggressive.

Depreciation

Most firms use the **straight-line depreciation** method for financial reporting purposes. However, most assets generate proportionally more benefits in their early years and an **accelerated depreciation** method is more appropriate for matching revenues and expenses. In the early years of an asset's life, the straight-line method will result in lower depreciation expense and higher net income than accelerated methods.

Straight-line depreciation (SL) allocates an equal amount of depreciation each year over the asset's useful life as follows:

$$\text{SL depreciation expense} = \frac{\text{cost} - \text{residual value}}{\text{useful life}}$$

The most common *accelerated method* of depreciation is the **double-declining balance method (DDB)**, which uses 200% of the straight-line rate, applied against the declining balance (value net of depreciation). If an asset's life is 10 years, the straight-line rate is 1/10 or 10%. The DDB rate for this asset is 2/10 or 20%.

$$\text{DDB depreciation} = \left(\frac{2}{\text{useful life}}\right)\left(\text{asset cost} - \begin{matrix}\text{accumulated} \\ \text{depreciation}\end{matrix}\right)$$

DDB does not use the residual value in the calculations, but depreciation stops once residual value has been reached.

Inventory

Under the **first-in, first-out (FIFO)** method, the first item purchased is the first item sold. FIFO is appropriate for inventory that has a limited shelf life. Under the **last-in, first-out (LIFO)** method, the last item purchased is the first item sold. LIFO is appropriate for inventory that does not deteriorate with age. For example, a coal mining company will sell coal off the top of the pile. The **average cost** method, which allocates the average cost of all inventory to each unit sold, is popular because of its ease of use.

In the United States, LIFO is popular because of the income tax benefits. LIFO results in higher cost of goods sold in an inflationary environment. Higher cost of goods sold results

in lower taxable income, and thus lower income taxes. LIFO inventory accounting is not permitted under IFRS.

Intangible Assets

Amortization expense of intangible assets with limited lives is similar to depreciation; the expense should match the benefits/value used over the period. Most firms, however, use the straight-line method. Goodwill and other intangible assets with *indefinite lives* are not amortized. However, they must be tested for impairment at least annually. If the asset is impaired, an expense is recognized in the income statement.

Operating and Nonoperating Components of the Income Statement

Operating and *nonoperating transactions* are usually reported separately in the income statement. For a nonfinancial firm, nonoperating transactions may result from investment income and financing expenses (interest). The income from and the gains and losses on the sale of these securities are not a part of the firm's normal business operations. For a financial firm, such income, gains, and losses may be considered operating income.

Discontinued Operations

A *discontinued operation* (must be physically and operationally distinct from the rest of the firm) is one that management has decided to dispose of, but either has not yet done so, or disposed of in the current period after the operation had generated income or losses. Income and losses from discontinued operations are reported separately in the income statement, net of tax, after income from continuing operations. While discontinued operations do not affect net income from continuing operations, the analyst must decide their effect on firm earnings and cash flows in the future.

Unusual or infrequent items are recorded for events that are either unusual in nature or infrequent in occurrence. Unusual or infrequent items are included in income from continuing operations. Examples include:

- Gains or losses from the sale of assets or part of a business (that do not qualify as discontinued operations).
- Impairments, write-offs, write-downs, and restructuring costs.

An analyst must review these to determine their effect, if any, on future income.

Accounting Changes

Accounting changes include changes in accounting policies, changes in accounting estimates, and prior-period adjustments. Such changes may require either **retrospective application** or **prospective application**. With retrospective application, any prior-period financial statements presented in a firm's current financial statements must be restated, applying the new policy to those statements as well as future statements. Retrospective application enhances the comparability of the financial statements over time. With prospective application, prior statements are not restated, and the new policies are applied only to future financial statements.

Standard setting bodies, at times, issue a **change in accounting policy**. Sometimes a firm may change which accounting policy it applies, such as changing its inventory costing method or capitalizing rather than expensing specific purchases. Unless it is impractical, changes in accounting policies require retrospective application.

In the recent change to revenue recognition standards, firms were given the option of *modified retrospective application*. This application does not require restatement of prior-period statements; however, beginning values of affected accounts are adjusted for the cumulative effects of the change.

Generally, a **change in accounting estimate** is the result of a change in management's judgment, usually due to new information. For example, management may change the estimated useful life of an asset because new information indicates the asset has a longer life than originally expected. Changes in accounting estimates are applied prospectively and do not require the restatement of prior financial statements. Accounting changes typically do not affect cash flow. An analyst should review accounting principle changes and changes in accounting estimates to determine their impact on future operating results.

Sometimes a change from an incorrect accounting method to one that is acceptable under GAAP or IFRS is required. A correction of an accounting error is reported as a **prior-period adjustment and requires retrospective application.** Prior-period results are restated. Disclosure of the nature of any significant prior-period adjustment and of its effect on net income is also required.

Prior-period adjustments usually involve errors or new accounting standards and typically do not affect cash flow unless tax accounting is also affected. Analysts should review adjustments carefully because errors may indicate weaknesses in the firm's internal control system.

Earnings Per Share

The following basic definitions are essential.

Potentially dilutive securities. These securities include stock options, warrants, convertible debt, and convertible preferred stock.

Dilutive securities. Those securities that would *decrease EPS* if exercised and converted to common stock.

Antidilutive securities. Those securities that would *increase EPS* if exercised and converted to common stock.

Simple capital structure. A capital structure that contains *no potentially dilutive* securities. This structure contains only common stock, nonconvertible debt, and nonconvertible preferred stock.

Complex capital structures. Complex structures contain *potentially dilutive securities* such as options, warrants, or convertible securities.

Weighted average number of shares outstanding. Each share issue is weighted by the portion of the year it was outstanding. Stock splits and stock dividends are applied retroactively to the beginning of the year, so "old" shares are converted to "new" shares for consistency.

Basic EPS

The basic EPS calculation *does not* consider the effects of any dilutive securities in the computation of EPS. It is the only EPS presented for firms with simple capital structures and is one of the two EPS calculations presented for firms with complex capital structures.

$$\text{basic EPS} = \frac{\text{net income} - \text{preferred dividends}}{\text{weighted average number of common shares outstanding}}$$

Diluted EPS

If a firm has a complex capital structure (contains potentially dilutive securities), both basic and diluted EPS must be reported. To calculate diluted EPS, treat any *dilutive* securities as if they were converted to common stock from the first of the year (or when issued if issued during the current year).

Each potentially dilutive security must be considered separately to determine whether or not it is actually dilutive for the current reporting period. Only income from continuing operations (excluding discontinued operations and accounting changes) is considered in determining diluted EPS.

To determine whether a convertible security is dilutive, calculate:

$$\frac{\text{convertible pfd. dividends}}{\text{\# shares from conversion of pfd.}} \quad \text{or}$$

$$\frac{\text{convertible debt interest (1–tax rate)}}{\text{\# shares from conversion of debt}}$$

If the calculated amount is less than basic EPS, the security is dilutive.

When considering dilutive securities, the denominator is the basic EPS denominator adjusted for the equivalent number of common shares created by the conversion of all outstanding dilutive securities (convertible bonds, convertible preferred shares, plus options and warrants).

$$\text{diluted EPS} = \frac{\text{adjusted income available for common shares}}{\text{weighted-average common and potential common shares outstanding}}$$

where adjusted income available for common shares is:
earnings available for common shares
+ dividends on dilutive convertible preferred stock
+ after-tax interest on dilutive convertible debt

Therefore, diluted EPS is:

$$\text{diluted EPS} = \frac{\left[\text{net income} - \begin{pmatrix}\text{preferred}\\ \text{dividends}\end{pmatrix}\right] + \begin{pmatrix}\text{convertible}\\ \text{preferred}\\ \text{dividends}\end{pmatrix} + \begin{pmatrix}\text{convertible}\\ \text{debt}\\ \text{interest}\end{pmatrix}(1-t)}{\begin{pmatrix}\text{weighted}\\ \text{average}\\ \text{shares}\end{pmatrix} + \begin{pmatrix}\text{shares from}\\ \text{conversion of}\\ \text{conv. pfd. shares}\end{pmatrix} + \begin{pmatrix}\text{shares from}\\ \text{conversion of}\\ \text{conv. debt}\end{pmatrix} + \begin{pmatrix}\text{shares}\\ \text{issuable from}\\ \text{stock options}\end{pmatrix}}$$

With respect to convertible bonds, remember that what you are looking for is a reduction in EPS. The denominator is rising due to the increased number of shares, and the numerator is rising due to the after-tax interest cost savings. When the denominator is rising faster than the numerator, conversion is dilutive.

Treasury Stock Method

The *treasury stock method* assumes that the hypothetical funds received by the company from the exercise of options or warrants are used to purchase shares of the company's common stock at the average market price over the reporting period.

Options and warrants are dilutive whenever the exercise price is less than the average stock price over the reporting period.

$$\text{new shares (treasury stock method)} = \frac{\text{avg. mkt. price} - \text{exercise price}}{\text{average market price}} \times \#\text{ of shares covered by options/warrants}$$

Financial Ratios Based on the Income Statement

A vertical **common-size income statement** expresses all income statement items as a percentage of sales. This format is useful for time-series and cross-sectional analysis and facilitates the comparison of firms of different sizes.

It is usually more meaningful to present income tax expense as an effective rate, equal to income tax expense divided by pre-tax income, than as a percentage of sales.

Profitability ratios examine how well management has done at generating profits from sales. The different ratios are designed to isolate specific costs. Generally, higher margin ratios are desirable.

Gross profit margin is the ratio of gross profit (sales less cost of goods sold) to sales:

$$\text{gross profit margin} = \frac{\text{gross profit}}{\text{revenue}}$$

Gross profit margin can be increased by raising sales prices or lowering per-unit cost.

Net profit margin is the ratio of net income to sales:

$$\text{net profit margin} = \frac{\text{net income}}{\text{revenue}}$$

Net profit margin can be increased by raising sales prices or cutting costs.

Any subtotal presented in the income statement can be expressed in terms of a margin ratio (to revenues). For example, *operating profit margin* is equal to operating income divided by revenue. *Pretax margin* is equal to pre-tax earnings divided by revenue.

Items Excluded from the Income Statement that Affect Owners' Equity

Transactions with owners:

1. Issuing or reacquiring stock.
2. Dividends paid.

Transactions included in other comprehensive income:

1. Foreign currency translation gains and losses.
2. Adjustments for minimum pension liability.
3. Unrealized gains and losses from *cash flow hedging* derivatives.
4. Unrealized gains and losses from *available-for-sale* securities (U.S. GAAP) or *securities measured at fair value through other comprehensive income* (IFRS).

Comprehensive income is a measure that includes all changes to equity other than owner contributions and distributions.

UNDERSTANDING BALANCE SHEETS

The balance sheet shows the values of the assets and liabilities of the firm at a point in time. Values may be historical values, fair market values, or historical values adjusted for amortization of premiums or discounts. Balance sheet items can be divided into assets, liabilities, and equity.

$$\text{assets} = \text{liabilities} + \text{owners' equity}$$

A **classified balance sheet** groups together similar items (current assets, current liabilities, current liabilities, noncurrent liabilities) to arrive at significant subtotals. Under IFRS, a **liquidity-based presentation** may be used if it is more relevant and reliable, as for a financial institution.

Accrual Process

The accrual method of accounting creates assets and liabilities.

- Cash received in advance of recognizing revenue results in an increase in assets (cash) and an increase in liabilities (unearned revenue).

- Recognizing revenue before cash is received results in an increase in assets (accounts receivable) and an increase in equity (retained earnings). Cash paid in advance of recognizing expense results in a decrease in one asset (cash) and an increase in another asset (prepaid expenses) by the same amount.
- Recognizing an expense before cash is paid results in an increase in liabilities (accrued expenses) and a decrease in equity (retained earnings).

Current and Noncurrent Assets and Liabilities

Current assets include cash and other assets that will be converted into cash or used up within one year or operating cycle, whichever is greater.

Current liabilities are obligations that will be satisfied within one year or operating cycle, whichever is greater. More specifically, a liability that meets any of the following criteria is considered current:

- Settlement is expected during the normal operating cycle.
- It is held for trading purposes.
- Settlement is expected within one year.
- There is no unconditional right to defer settlement for at least one year.

Current assets minus current liabilities equals **working capital**.

Noncurrent assets do not meet the definition of current assets; that is, they will not be converted into cash or used up within one year or operating cycle.

Noncurrent liabilities do not meet the criteria of current liabilities.

If a firm includes (consolidates) balance sheet accounts of a subsidiary that is not 100% owned, the firm reports a **noncontrolling interest** or **minority interest** in its consolidated balance sheet. The noncontrolling interest is the pro-rata share of the subsidiary's net assets (equity) not owned by the parent company. Noncontrolling interest is reported in the equity section of the consolidated balance sheet.

Measurement Bases of Assets and Liabilities

Balance sheet assets and liabilities are valued using both **historical cost** and **fair value**.

- *Historical cost* is the value that was exchanged at the acquisition date. Historical cost is objective (highly reliable), but its relevance to an analyst declines as values change.
- *Fair value* is the amount at which an asset could be sold, or a liability transferred, in an orderly transaction between willing parties.

Some of the more common current assets are:

- **Cash, and cash equivalents**—cash equivalents typically mature in 90 days or less (e.g., 90-day T-bills).
- **Accounts receivable (trade receivables)**—receivables are reported net of any allowance for bad debt.
- **Inventories**—items held for sale or used in the manufacture of goods to be sold. Firms that use the **retail method** measure inventory at retail prices and subtract an expected gross margin to reflect cost.

- **Marketable securities**—debt or equity securities that are traded in a public market.
- **Other current assets**—includes prepaid expenses.

Some examples of **current liabilities** are:

- **Accounts payable (trade payables)**—amounts owed to suppliers.
- **Notes payable**—obligations in the form of promissory notes due to creditors within one year or operating cycle, whichever is greater.
- **Current portion of long-term debt**—the principal portion of debt due within one year or operating cycle, whichever is greater.
- **Taxes payable**—current taxes that have been recognized in the income statement but have not yet been paid.
- **Accrued liabilities (accrued expenses)**—expenses that have been recognized in the income statement but are not yet contractually due.
- **Unearned revenue (income)**—cash collected in advance of providing goods and services. The related liability is to provide those goods and services.

Tangible Assets

Long-term assets with physical substance are known as *tangible assets*. Tangible assets, such as plant, equipment, and natural resources, are reported on the balance sheet at historical cost less accumulated depreciation or depletion.

Land is also a tangible asset that is reported at historical cost and is not depreciated.

Under IFRS, tangible assets held for capital appreciation or to earn rental income are classified as **investment property**.

Intangible Assets

Intangible assets are long-term assets that lack physical substance. The cost of an identifiable intangible asset is amortized over its useful life. Examples of identifiable intangible assets include patents, trademarks, and copyrights.

An intangible asset that is *unidentifiable* cannot be purchased separately and may have an infinite life. The best example of an unidentifiable intangible asset is goodwill.

Goodwill is created when a business is purchased for more than the fair value of its assets net of liabilities. Goodwill is not amortized, but must be tested for impairment (a decrease in its fair value) at least annually. Since goodwill is not amortized, firms can manipulate net income upward by allocating more of the acquisition price to goodwill and less to the identifiable assets. The result is less depreciation and amortization expense and thus higher net income.

When computing ratios, analysts should eliminate goodwill from the balance sheet and goodwill impairment charges from the income statement for comparability. Also, analysts should evaluate future acquisitions in terms of the price paid relative to the earning power of the acquired firm.

Intangible assets that are purchased are reported on the balance sheet at historical cost less accumulated amortization. Except for certain legal costs, intangible assets that are

created internally, including research and development costs, are expensed as incurred under U.S. GAAP and are not shown on the balance sheet.

Under IFRS, a firm must identify the research stage and the development stage. Accordingly, the firm must expense costs during the research stage but *may* capitalize costs incurred during the development stage.

All of the following should be expensed as incurred, and do not create balance sheet assets:

- Start-up and training costs.
- Administrative overhead.
- Advertising and promotion costs.
- Relocation and reorganization costs.
- Termination costs.

Some analysts completely eliminate intangible assets, particularly unidentifiable intangibles, for analytical purposes. This is inadvisable. Analysts should consider the economic value of each intangible asset before making an adjustment.

Accounting Treatments for Financial Instruments

IFRS has three categories for securities held as assets. These categories reflect how they are valued and how unrealized gains and losses are reported in the financial statements. The IFRS categories are:

- Securities measured at amortized cost.
- Securities measured at fair value though other comprehensive income.
- Securities measured at fair value through profit and loss.

U.S. GAAP has three categories that mostly correspond to the IFRS treatments:

- Held-to-maturity securities.
- Available-for-sale securities.
- Trading securities.

Debt securities that firm intends to hold until maturity, notes receivable, and unlisted securities for which fair value cannot be reliably determined, are all measured at amortized historical cost.

Debt securities for which a firm intends to collect interest payments but may sell prior to maturity are measured at fair value through other comprehensive income under IFRS and classified as available-for-sale under U.S. GAAP.

Equity securities, derivatives, and other financial assets that do not fit either of the other two classifications are measured at fair value through profit and loss under IFRS and classified as trading securities under U.S. GAAP.

Under IFRS, firms may make an irrevocable choice at the time of purchase to account for equity securities as measured at fair value through other comprehensive income. Also, IFRS firms can make an irrevocable choice to carry any financial asset at fair value through profit and loss. These choices are not available under U.S. GAAP.

Components of Owners' Equity

Owners' equity is the residual interest in assets that remains after subtracting an entity's liabilities. The owners' equity section of the balance sheet includes:

- **Contributed capital**—the total amount received from the issuance of common and preferred stock.
- **Noncontrolling interest** (minority interest)—the minority shareholders' pro-rata share of the net assets (equity) of a consolidated subsidiary that is partially owned by the parent.
- **Retained earnings**—the cumulative net income of the firm since inception that has not been paid out as dividends.
- **Treasury stock**—stock that has been reacquired by the issuing firm but not yet retired. Treasury stock has no voting rights and does not receive dividends.
- **Accumulated other comprehensive income**—includes all changes in stockholders' equity not recognized in the income statement or from issuing stock, reacquiring stock, and paying dividends.

The **statement of changes in stockholders' equity** summarizes all transactions that increase or decrease the equity accounts for the period.

Analysis of the Balance Sheet

A vertical **common-size balance sheet** expresses all balance sheet accounts as a percentage of total assets and allows the analyst to evaluate the balance sheet changes over time (*time-series analysis*) as well as to compare the balance sheets with other firms, industry, and sector data (*cross-sectional analysis*). Several commercial services provide data for comparison.

Liquidity ratios measure the firm's ability to satisfy short-term obligations when due.

- The **current ratio** is the best-known measure of liquidity.

$$\text{current ratio} = \frac{\text{current assets}}{\text{current liabilities}}$$

  A current ratio of less than one means the firm has negative working capital and may be facing a liquidity crisis. Working capital is equal to current assets minus current liabilities.

- The **quick ratio** (acid test ratio) is a more conservative measure of liquidity because it excludes inventories and less liquid current assets from the numerator.

$$\text{quick ratio} = \frac{\text{cash} + \text{marketable securities} + \text{receivables}}{\text{current liabilities}}$$

- The **cash ratio** is the most conservative measure of liquidity.

$$\text{cash ratio} = \frac{\text{cash} + \text{marketable securities}}{\text{current liabilities}}$$

  The higher its liquidity ratios, the more likely the firm will be able to pay its short-term bills when due. The ratios differ only in the assumed liquidity of the current assets.

Solvency ratios measure a firm's financial risk and measure the firm's ability to satisfy long-term obligations (its solvency). The higher the ratio, the greater the financial leverage and the greater the financial risk.

- The **long-term debt-to-equity ratio** measures long-term financing sources relative to the equity base.

$$\text{long-term debt-to-equity} = \frac{\text{total long-term debt}}{\text{total equity}}$$

- The **debt-to-equity ratio** measures total debt relative to the equity base.

$$\text{debt-to-equity} = \frac{\text{total debt}}{\text{total equity}}$$

- The **total debt ratio** measures the extent to which assets are financed by creditors.

$$\text{total debt ratio} = \frac{\text{total debt}}{\text{total assets}}$$

- The **financial leverage ratio** is a variation of the debt-to-equity ratio that is used as a component of the DuPont model.

$$\text{financial leverage ratio} = \frac{\text{total assets}}{\text{total equity}}$$

UNDERSTANDING CASH FLOW STATEMENTS

The **cash flow statement** provides information beyond that available from net income and other financial data. The cash flow statement provides information about a firm's liquidity, solvency, and financial flexibility. The cash flow statement reconciles the beginning and ending balances of cash over an accounting period. The change in cash is a result of the firm's operating, investing, and financing activities as follows:

	Operating activities
+	Investing activities
+	Financing activities
=	Change in cash balance
+	Beginning cash balance
=	Ending cash balance

Figure 1: U.S. GAAP Cash Flow Classifications

Operating Activities	
Inflows	*Outflows*
Cash collected from customers	Cash paid to employees and suppliers
Interest and dividends received	Cash paid for other expenses
Sale proceeds from trading securities	Acquisition of trading securities
	Interest paid on debt or leases
	Taxes paid
Investing Activities	
Inflows	*Outflows*
Sale proceeds from fixed assets	Acquisition of fixed assets
Sale proceeds from debt & equity investments	Acquisition of debt & equity investments
Principal received from loans made to others	Loans made to others
Financing Activities	
Inflows	*Outflows*
Principal amounts borrowed from others	Principal paid on debt or leases
	Payments to reacquire stock
Proceeds from issuing stock	Dividends paid to shareholders

Noncash investing and financing activities are not reported in the cash flow statement but must be disclosed in either a footnote or a supplemental schedule to the cash flow statement.

Differences Between U.S. GAAP and IFRS

Under IFRS:

- Interest and dividends received may be classified as either CFO or CFI.
- Dividends paid to shareholders and interest paid on debt may be classified as either CFO or CFF.
- Income taxes are reported as operating activities unless the expense can be tied to an investing or financing transaction.

Direct Method and Indirect Methods Calculating CFO

Two different methods of presenting the cash flow statement are permitted under U.S. GAAP and IFRS: the direct method and the indirect method. The use of the direct method is encouraged by both standard setters. The difference in the two methods relates to the presentation of cash flow from operating activities. Total cash flow from operating activities is exactly the same under both methods, and the presentation of cash flow from investing activities and from financing activities is exactly the same under both methods.

The direct method provides more information than the indirect method. The main advantage of the indirect method is that it focuses on the differences between net income and operating cash flow.

Direct Method

The direct method presents operating cash flow by taking each item from the income statement and converting it to its cash equivalent by adding or subtracting the changes in the corresponding balance sheet accounts. The following are examples of operating cash flow components:

- Cash collected from sales is the main component of CFO. Cash collections are calculated by adjusting sales for the changes in accounts receivable and unearned (deferred) revenue.
- Cash used in the production of goods and services (cash inputs) is calculated by adjusting cost of goods sold (COGS) for the changes in inventory and accounts payable.

Indirect Method

Using the indirect method, operating cash flow is calculated in four steps:

Step 1: Begin with net income.

Step 2: Add or subtract changes to related balance sheet operating accounts as follows:

- Increases in the operating asset accounts (uses of cash) are subtracted, while decreases (sources of cash) are added.
- Increases in the operating liability accounts (sources of cash) are added, while decreases (uses of cash) are subtracted.

Step 3: Add back all noncash charges to income (such as depreciation and amortization) and subtract all noncash components of revenue.

Step 4: Subtract gains or add losses that resulted from financing or investing cash flows (such as gains from sale of land).

Most firms present the cash flow statement using the indirect method. For analytical purposes, it may be beneficial to *convert the cash flow statement to the direct method*. Examples of such conversion for two items are:

Cash collections from customers:

1. Begin with net sales from the income statement.
2. Subtract (add) any increase (decrease) in the accounts receivable balance as reported in the indirect method.
3. Add (subtract) an increase (decrease) in unearned revenue.

Cash payments to suppliers:

1. Begin with cost of goods sold (COGS) as reported in the income statement.
2. If depreciation and/or amortization have been included in COGS (they increase COGS), they must be eliminated when computing the cash paid to suppliers.

3. Subtract (add) any increase (decrease) in the accounts payable balance as reported in the indirect method.
4. Add (subtract) any increase (decrease) in the inventory balance as disclosed in the indirect method.
5. Subtract any inventory write-off that occurred during the period.

Disclosure Requirements

Under U.S. GAAP, a direct method presentation must also disclose the adjustments necessary to reconcile net income to cash flow from operating activities. The reconciliation is not required under IFRS.

Under IFRS, payments for interest and taxes must be disclosed separately in the cash flow statement under either method (direct or indirect). Under U.S. GAAP, payments for interest and taxes can be reported in the cash flow statement or disclosed in the footnotes.

Investing and Financing Cash Flows

Investing cash flows (CFI) are calculated by subtracting expenditures on new assets from the proceeds of asset sales.

When calculating the cash from an asset that has been sold, it is necessary to consider any gain or loss from the sale using the following formula:

$$\text{cash from asset sold} = \text{book value of the asset} + \text{gain (or} - \text{loss) on sale}$$

Financing cash flows (CFF) are determined by measuring the cash flows occurring between the firm and its suppliers of capital. Cash flows between the firm and creditors result from new borrowings and debt repayments. Note that interest paid is technically a cash flow to the creditors, but it is already included in CFO under U.S. GAAP. Cash flows between the firm and the shareholders occur when equity is issued, shares are repurchased, and dividends are paid. CFF is the sum of these two measures:

$$\text{net cash flows from creditors} = \text{new borrowings} - \text{principal repaid}$$

$$\text{net cash flows from shareholders} = \text{new equity issued} - \text{share repurchases} - \text{cash dividends}$$

Analysis of the Cash Flow Statement

1. Operating Cash Flow

The analyst should identify the major determinants of operating cash flow, primarily the firm's earning-related activities and changes in noncash working capital.

Equality of operating cash flow and net income is an indication of high-quality earnings but can be affected by the stage of business cycle and of the firm's life cycle. Earnings that exceed operating cash flow may be an indication of premature recognition of revenues or delayed recognition of expenses.

2. Investing Cash Flow

Increasing capital expenditures, a use of cash, is usually an indication of growth. Conversely, a firm may reduce capital expenditures or even sell capital assets in order to conserve or generate cash. This may result in higher cash outflows in the future as older assets are replaced or growth resumes.

3. Financing Cash Flow

The financing activities section of the cash flow statement reveals information about whether the firm is generating cash by issuing debt or equity. It also provides information about whether the firm is using cash to repay debt, reacquire stock, or pay dividends.

The cash flow statement can be converted to **common-size format** by expressing each line item as a percentage of revenue. Alternatively, each inflow of cash can be expressed as a percentage of total cash inflows and each outflow of cash can be expressed as a percentage of total cash outflows.

Free cash flow is a measure of cash that is available for discretionary purposes; that is, the cash flow that is available once the firm has covered its obligations and capital expenditures.

Free cash flow to the firm (FCFF) is the cash available to all investors, including stockholders and debt holders. FCFF can be calculated using net income or operating cash flow as a starting point.

FCFF is calculated from net income as:

$$\begin{aligned}\text{FCFF} = {} & \text{NI} + \text{non-cash charges} + \\ & [\text{cash interest paid} \times (1 - \text{tax rate})] - \text{net capital} \\ & \text{investment} - \text{working capital investment}\end{aligned}$$

FCFF is calculated from operating cash flow as:

$$\begin{aligned}\text{FCFF} = {} & \text{CFO} + [\text{cash interest paid} \times (1 - \text{tax rate})] \\ & - \text{net capital expenditure}\end{aligned}$$

Free cash flow to equity (FCFE) is the cash flow that is available for distribution to the common shareholders; that is, after all obligations have been paid. FCFE can be calculated as follows:

$$\text{FCFE} = \text{CFO} - \text{net capital expenditure} + \text{net borrowing}$$

Cash Flow Ratios That Measure Performance

- The **flow-to-revenue ratio** measures the amount of operating cash flow generated for each dollar of revenue.

$$\text{cash flow-to-revenue} = \frac{\text{CFO}}{\text{net revenue}}$$

- The **cash return-on-assets ratio** measures the return of operating cash flow attributed to all providers of capital.

$$\text{cash return-on-assets} = \frac{\text{CFO}}{\text{average total assets}}$$

Cash Flow Ratios That Measure Coverage

- The **debt coverage ratio** measures financial risk and leverage.

$$\text{debt coverage} = \frac{\text{CFO}}{\text{total debt}}$$

- The **interest coverage ratio** measures the firm's ability to meet its interest obligations.

$$\text{interest coverage} = \frac{\text{CFO} + \text{interest paid} + \text{taxes paid}}{\text{interest paid}}$$

FINANCIAL ANALYSIS TECHNIQUES

With respect to analysis of financial statements, there are a number of key ratios that should simply be memorized including:

- Current, quick, and cash ratios.
- All the ratios in the cash conversion cycle (the turnover ratios are more important, like receivables, inventory, and payables turnover).
- Turnover ratios use sales in the numerator, except for payables and inventory turnover ratios, which use purchases and COGS, respectively.
- Gross profit margin, net profit margin, and operating profit margin are readily available from a common-size income statement.
- Return on equity (ROE) is critical. Definitely know the three- and five-component DuPont ROE decompositions.
- Debt-to-equity, total debt, interest coverage, and fixed financial coverage ratios (remember to add lease interest expense to numerator and denominator).
- The retention ratio and growth rate are important concepts that also appear in Corporate Finance and Equity Investments.

Usefulness and Limitations of Ratio Analysis

Financial ratios provide useful information to analysts, including:

- Insights into the financial relationships that are useful in forecasting future earnings and cash flows.
- Information about the financial flexibility of the firm.
- A means of evaluating management's performance.

Financial ratios have limitations:

- Ratios are not useful when viewed in isolation. Ratios should be interpreted relative to industry averages, economy-wide firm averages, and the company's own historical performance.

- Comparisons with other companies are made more difficult because of different accounting methods. Some of the more common differences include inventory methods (FIFO and LIFO), depreciation methods (accelerated and straight-line), and lease accounting (capital and operating).
- There may be difficulty in locating comparable ratios when analyzing companies that operate in multiple industries.
- Conclusions cannot be made from viewing one set of ratios. Ratios must be viewed relative to one another.
- Judgment is required. Determining the target or comparison value for a ratio is difficult and may require some range of acceptable values.

Common-size balance sheets and income statements. These statements normalize balance sheets and income statements and allow the analyst to make easier comparisons of different-sized firms. A vertical common-size balance sheet expresses each balance sheet account as a *percentage of total assets*. A horizontal common-size balance sheet expresses each account as a ratio to the first-year value (e.g., 1.1 indicates an increase of 10% above the first-year value). A vertical common-sized income statement expresses each income statement item as a *percentage of sales*.

Measures of liquidity:

$$\text{current ratio} = \frac{\text{current assets}}{\text{current liabilities}}$$

$$\text{quick ratio} = \frac{\text{cash} + \text{marketable securities} + \text{receivables}}{\text{current liabilities}}$$

Measures of operating performance—turnover ratios and the cash conversion cycle:

$$\text{receivables turnover} = \frac{\text{annual sales}}{\text{average receivables}}$$

$$\text{inventory turnover} = \frac{\text{cost of goods sold}}{\text{average inventory}}$$

$$\text{payables turnover ratio} = \frac{\text{purchases}}{\text{average trade payables}}$$

$$\text{days of sales outstanding} = \frac{365}{\text{receivables turnover}}$$

$$\text{days of inventory on hand} = \frac{365}{\text{inventory turnover}}$$

$$\text{number of days of payables} = \frac{365}{\text{payables turnover ratio}}$$

$$\begin{matrix}\text{cash}\\ \text{conversion}\\ \text{cycle}\end{matrix} = \begin{pmatrix}\text{days of sales}\\ \text{outstanding}\end{pmatrix} + \begin{pmatrix}\text{days of inventory}\\ \text{on hand}\end{pmatrix} - \begin{pmatrix}\text{number of}\\ \text{days of}\\ \text{payables}\end{pmatrix}$$

Measures of operating performance—operating efficiency ratios:

$$\text{total asset turnover} = \frac{\text{revenue}}{\text{average total assets}}$$

$$\text{fixed asset turnover} = \frac{\text{revenue}}{\text{average net fixed assets}}$$

$$\text{working capital turnover} = \frac{\text{revenue}}{\text{average working capital}}$$

Measures of operating performance—operating profitability:

$$\text{gross profit margin} = \frac{\text{gross profit}}{\text{revenue}}$$

$$\text{operating profit margin} = \frac{\text{operating income}}{\text{revenue}} = \frac{\text{EBIT}}{\text{revenue}}$$

$$\text{net profit margin} = \frac{\text{net income}}{\text{revenue}}$$

Return on total capital (ROTC):

$$\text{return on total capital} = \frac{\text{EBIT}}{\text{average total capital}}$$

Total capital includes debt capital, so interest is added back to net income.

Return on equity (ROE):

$$\text{return on total equity} = \frac{\text{net income}}{\text{average total equity}}$$

$$\text{return on common equity} = \frac{\text{net income} - \text{preferred dividends}}{\text{average common equity}}$$

Measures of solvency:

$$\text{debt-to-equity ratio} = \frac{\text{total debt}}{\text{total shareholders' equity}}$$

$$\text{debt-to-capital} = \frac{\text{total debt}}{\text{total debt} + \text{total shareholders' equity}}$$

$$\text{debt-to-assets} = \frac{\text{total debt}}{\text{total assets}}$$

$$\text{debt-to-EBITDA} = \frac{\text{total debt}}{\text{EBITDA}}$$

$$\text{financial leverage} = \frac{\text{average total assets}}{\text{average total equity}}$$

Measures of interest coverage:

$$\text{interest coverage} = \frac{\text{EBIT}}{\text{interest payments}}$$

$$\text{fixed charge coverage} = \frac{\text{EBIT} + \text{lease payments}}{\text{interest payments} + \text{lease payments}}$$

Growth analysis:

$$g = \text{retention rate} \times \text{ROE}$$

$$\text{retention rate} = 1 - \frac{\text{dividends declared}}{\text{net income available to common}}$$

DuPont analysis. The DuPont method decomposes the ROE to better analyze firm performance. An analyst can see the impact of leverage, profit margin, and turnover on ROE. There are two variants of the DuPont system: the traditional approach and the extended system.

Both approaches begin with:

$$\text{return on equity} = \left(\frac{\text{net income}}{\text{equity}}\right)$$

The *traditional DuPont equation* is:

$$\text{return on equity} = \left(\frac{\text{net income}}{\text{sales}}\right)\left(\frac{\text{sales}}{\text{assets}}\right)\left(\frac{\text{assets}}{\text{equity}}\right)$$

You may also see it presented as:

$$\text{return on equity} = \begin{pmatrix}\text{net profit}\\ \text{margin}\end{pmatrix}\begin{pmatrix}\text{asset}\\ \text{turnover}\end{pmatrix}\begin{pmatrix}\text{leverage}\\ \text{ratio}\end{pmatrix}$$

The traditional DuPont equation is arguably the most important equation in ratio analysis since it breaks down a very important ratio (ROE) into three key components. If ROE is low, it must be that at least one of the following is true: the company has a poor profit margin; the company has poor asset turnover; or the firm is under-leveraged.

The *extended DuPont equation* takes the net profit margin and breaks it down further. The extended DuPont equation can be written as:

$$\text{ROE} = \left(\frac{\text{net income}}{\text{EBT}}\right)\left(\frac{\text{EBT}}{\text{EBIT}}\right)\left(\frac{\text{EBIT}}{\text{revenue}}\right)\left(\frac{\text{revenue}}{\text{total assets}}\right)\left(\frac{\text{total assets}}{\text{total equity}}\right)$$

You may also see it presented as:

$$\text{ROE} = \begin{pmatrix}\text{tax}\\ \text{burden}\end{pmatrix}\begin{pmatrix}\text{interest}\\ \text{burden}\end{pmatrix}\begin{pmatrix}\text{EBIT}\\ \text{margin}\end{pmatrix}\begin{pmatrix}\text{asset}\\ \text{turnover}\end{pmatrix}\begin{pmatrix}\text{financial}\\ \text{leverage}\end{pmatrix}$$

Pro Forma Financial Statements

Both common-size financial statements and ratio analysis can be used in preparing pro forma financial statements. A forecast of financial results that begins with an estimate of a firm's next-period revenues might use the most recent COGS from a common-size income statement. Similarly, the analyst may believe that certain ratios will remain the same or change in one direction or the other for the next period. In the absence of any information indicating a change, an analyst may choose to incorporate the operating profit margin and other ratios from the prior period into a pro forma income statement for the next period. Beginning with an estimate of next-period sales, the estimated operating profit margin can be used to forecast operating profits for the next period.

Following are three methods of examining the variability of financial outcomes around point estimates:

1. **Sensitivity analysis** is based on "what if" questions, such as: What will be the effect on net income if sales increase by 3% rather than the estimated 5%?

2. **Scenario analysis** is based on specific scenarios (a specific set of outcomes for key variables) and will also yield a range of values for financial statement items.
3. **Simulation** is a technique in which probability distributions for key variables are selected and a computer generates a distribution of outcomes based on repeated random selection of values for the key variables.

INVENTORIES

For a manufacturing firm, raw materials, goods in process, and finished goods are recorded on the balance sheet as a current asset called inventory.

Costs included in inventory on the balance sheet include:

- Purchase cost.
- Conversion cost.
- Allocation of fixed production overhead based on normal capacity levels.
- Other costs necessary to bring the inventory to its present location and condition.

All of these costs for inventory acquired or produced in the current period are added to beginning inventory value and then allocated either to cost of goods sold for the period or to ending inventory.

Period costs, such as unallocated overhead, abnormal waste, most storage costs, administrative costs, and selling costs, are expensed.

Rather than using actual costs, firms may choose to use one of two other techniques, as long as the resulting values approximate actual cost.

- With **standard costing**, unit cost is based on predetermined amounts of materials, labor, and overhead.
- With the **retail method**, unit costs are calculated as retail prices less gross profit margin.

Inventory Cost Allocation Methods

The cost of goods sold during a period can be accounted for using one of several methods, referred to as **cost flow methods**.

First-in, first-out (FIFO) assumes costs incurred for items that are purchased or manufactured first are the first costs to enter the cost of goods sold (COGS) computation. The balance of ending inventory is made up of those costs most recently incurred.

Last-in, first-out (LIFO) assumes costs incurred for items that are purchased or manufactured most recently are the first costs to enter the COGS computation. The balance of ending inventory is made up of costs that were incurred for items purchased or manufactured at the earliest time. Note that in the United States, companies using LIFO for tax purposes must also use LIFO in their financial statements, and that LIFO is not permitted under IFRS.

Weighted average costing calculates an average cost per unit by dividing cost of goods available by total units available. This average cost is used to determine both COGS and ending inventory.

With the *specific identification* method, individual items in inventory, such as a car dealer's cars in inventory, are carried at their individual costs and added to COGS as they are sold.

All of these methods are permitted under U.S. GAAP, but IFRS do not permit the LIFO method.

Inventory Values on the Balance Sheet

Under IFRS, inventories are valued at the lower of cost or net realizable value, which is estimated sales proceeds net of direct selling costs. Inventory "write-up" is allowed, but only to the extent that a previous write-down to net realizable value was recorded.

Under U.S. GAAP, firms that use LIFO or the retail method value inventories at the lower of cost or market. "Market" is usually equal to replacement cost but cannot exceed net realizable value or be less than net realizable value minus a normal profit margin. For firms using cost methods other than LIFO or retail, inventory valuation is similar to IFRS. No subsequent "write-up" of inventory values that have been written down is allowed under U.S. GAAP.

Periodic and Perpetual Inventory Systems

Firms account for changes in inventory using either a periodic or perpetual system. In a **periodic inventory system**, inventory values and COGS are determined at the end of the accounting period. No detailed records of inventory are maintained; rather, inventory acquired during the period is reported in a Purchases account. At the end of the period, purchases are added to beginning inventory to arrive at cost of goods available for sale. To calculate COGS, ending inventory is subtracted from goods available for sale.

In a **perpetual inventory system**, inventory values and COGS are updated continuously. Inventory purchased and sold is recorded directly in inventory when the transactions occur. Thus, a Purchases account is not necessary.

For the FIFO and specific identification methods, ending inventory values and COGS are the same whether a periodic or perpetual system is used. However, periodic and perpetual inventory systems can produce different values for inventory and COGS under the LIFO and weighted average cost methods.

LIFO vs. FIFO

In periods of rising prices and stable or increasing inventory quantities:

LIFO results in:	FIFO results in:
Higher COGS	Lower COGS
Lower gross profit	Higher gross profit
Lower inventory balances	Higher inventory balances

In periods of falling prices:

LIFO results in:	FIFO results in:
Lower COGS	Higher COGS
Higher gross profit	Lower gross profit
Higher inventory balances	Lower inventory balances

For a firm using the (weighted) average cost inventory method, all of these values will be between those for the LIFO and FIFO methods.

LIFO Reserve

Firms that report under LIFO must report a **LIFO reserve**, the amount by which LIFO inventory is less than FIFO inventory. To make financial statements prepared under LIFO comparable to those of FIFO firms, an analyst must:

1. Add the LIFO reserve to LIFO inventory.
2. Increase retained earnings by the LIFO reserve.

When prices are increasing, a LIFO firm will pay less in taxes than it would pay under FIFO. For this reason, analysts often decrease a LIFO firm's cash by the tax rate times the LIFO reserve and increase retained earnings by the LIFO reserve net of tax, instead of the full LIFO reserve.

The difference between LIFO COGS and FIFO COGS is equal to the change in the LIFO reserve for the period. To convert COGS from LIFO to FIFO, simply subtract the change in the LIFO reserve.

LIFO Liquidation

A **LIFO liquidation** occurs when a LIFO firm's inventory quantities decline. In a rising price environment, COGS are based on older, lower unit costs, which makes COGS artificially low. The reduction in COGS from a LIFO liquidation increases gross and net profits and margins, but these increases are not sustainable. A decrease in the LIFO reserve (disclosed in footnotes for LIFO companies) can alert analysts that a LIFO liquidation may be responsible for an increase in current-period profits and profit margins.

Ratios for Evaluating Inventory Management

Ratios that are directly affected by the choice of inventory accounting method include inventory turnover, days of inventory, and gross profit margin.

High inventory turnover relative to other firms in an industry may indicate too little inventory and low turnover may indicate inventory that is too great. Comparing the firm's revenue growth to that of the industry can provide information on whether inventories are too large (slow moving or obsolete) or too small (so that sales are lost to a significant degree).

Ratios and Inventory Method

Profitability. As compared to FIFO, LIFO produces higher COGS in the income statement and will result in lower earnings. Any profitability measure that includes COGS will be

lower under LIFO. For example, higher COGS will result in lower gross, operating, and net profit margins as compared to FIFO.

Liquidity. Compared to FIFO, LIFO results in a lower inventory value on the balance sheet. Because inventory (a current asset) is lower under LIFO, the current ratio, a popular measure of liquidity, is also lower under LIFO than under FIFO. Working capital is lower under LIFO as well because current assets are lower. The quick ratio is unaffected by the firm's inventory cost flow method because inventory is excluded from its numerator.

Activity. Inventory turnover (COGS / average inventory) is higher for firms that use LIFO compared to firms that use FIFO. Under LIFO, COGS is valued at more recent, higher costs (higher numerator), while inventory is valued at older, lower costs (lower denominator). Higher turnover under LIFO will result in lower days of inventory on hand (365 / inventory turnover).

Solvency. LIFO results in lower total assets compared to FIFO because LIFO inventory is lower. Lower total assets under LIFO result in lower stockholders' equity (assets − liabilities). Because total assets and stockholders' equity are lower under LIFO, the debt ratio and the debt-to-equity ratio are higher under LIFO compared to FIFO.

LONG-LIVED ASSETS

The purchase cost of assets that will provide economic benefits to the firm over more than one year is typically not taken as an expense in the year of acquisition, but is capitalized (creating an asset on the balance sheet) and spread over an asset's useful economic life by recording depreciation of the asset's value.

Compared to taking the acquisition cost as an expense in the period of acquisition, capitalization decreases expenses (which increases net income), increases assets and equity (which decreases reported leverage), reduces income variability, and increases operating cash flow and decreases investing cash flow in the same amounts, since the cost of a capitalized assets is treated as an investing cash flow rather than an operating cash flow.

The following table summarizes the financial implications of capitalizing versus expensing:

	Capitalizing	Expensing
Income variability	Lower	Higher
Profitability—first year (ROA & ROE) and Net Income	Higher	Lower
Profitability—later years (ROA & ROE) and Net Income	Lower	Higher
Total cash flows (assuming no tax effects)	Same	Same
Cash flow from operations	Higher	Lower
Cash flow from investing	Lower	Higher
Leverage ratios (debt/equity & debt/assets)	Lower	Higher

Capitalization of interest. Interest costs incurred when constructing assets over multiple periods for firm use or for sale must be capitalized under both U.S. GAAP and IFRS, either to the balance sheet asset value or to inventory, respectively. The expense is recognized over time as either asset depreciation or in COGS when a constructed asset is sold.

Capitalization of construction interest reduces interest expense in the period of capitalization and increases either depreciation or COGS. Capitalized interest expense is treated as an investing, rather than operating, cash outflow and an analyst should take account of this difference. To better measure interest coverage, an analyst should add capitalized interest to interest expense and increase EBIT by adding depreciation expense from previously capitalized interest.

Internally Created Intangible

For internally generated intangible assets, firms reporting under IFRS must expense research costs as incurred but may capitalize development costs (costs incurred after technological feasibility and the intent to use or sell the completed asset have been established).

Under U.S. GAAP, generally both research and development expenditures related to internally created intangible assets must be expensed as incurred. An exception is the creation of software for internal use or sale to others. After specific criteria are met, costs to develop software must be capitalized under U.S. GAAP.

Depreciation

The historical cost of capitalized physical assets is allocated over their economic (useful) lives by recording depreciation expense. Depreciation methods include straight-line (an equal amount each period), accelerated (greater in the early years of an asset's life), and units-of-production (proportional to asset use).

Straight-line depreciation:

$$\text{depreciation expense} = \frac{\text{original cost} - \text{salvage value}}{\text{depreciable life}}$$

Double-declining balance (an accelerated method):

$$\text{DDB depreciation in year } x = \frac{2}{\text{asset life in years}} \times \text{book value at beginning of year } x$$

Note that the salvage value is not used to compute annual depreciation under the double-declining balance method. The end-of-period book (carrying) value of an asset, however, is not allowed to go below its estimated salvage value.

Units of production and service hours depreciation. Under this method, an asset's depreciable basis is divided by estimated units of production or total service hours. Each period, depreciation is calculated as cost-per-unit (hour) times the number of units produced (hours of service).

Financial Statement Effects of Depreciation Methods

In the early years of an asset's life, using an accelerated depreciation method will result in higher depreciation expense and lower net income, total assets, and shareholders' equity, compared to straight-line depreciation. For a single long-lived asset, these effects reverse in the later years of its useful life.

Return on assets and return on equity are higher with straight-line depreciation compared to accelerated methods. This is because the effect on the numerators (higher net income) is larger in percentage terms than the effect on the denominators (higher assets and equity). Asset turnover ratios (revenue / average assets) are lower with straight-line depreciation. Assuming the depreciation method for tax is unchanged, a change in depreciation method for financial reporting will not affect cash flows.

Figure 2 summarizes the effects of depreciation methods on financial statements and ratios in the early years of an asset's useful life.

Figure 2: Effects of Depreciation Methods (Early Years)

	Straight-Line	Accelerated
Depreciation expense	Lower	Higher
Net income	Higher	Lower
Total assets	Higher	Lower
Shareholders' equity	Higher	Lower
Return on assets	Higher	Lower
Return on equity	Higher	Lower
Asset turnover ratios	Lower	Higher
Cash flow	Same	Same

Useful Lives and Salvage Values

Calculating depreciation expense requires estimating an asset's useful life and its salvage (residual) value. Firms can manipulate depreciation expense, and therefore net income, by increasing or decreasing either of these estimates.

A longer estimated useful life decreases annual depreciation and increases reported net income, while a shorter estimated useful life will have the opposite effect. A higher estimate of the salvage value will also decrease depreciation and increase net income, while a lower estimate of the salvage value will increase depreciation and decrease net income.

A change in an accounting estimate, such as useful life or salvage value, is put into effect in the current period and prospectively. That is, the change in estimate is applied to the asset's carrying (book) value and depreciation is calculated going forward using the new estimate. The previous periods are not affected by the change.

Intangible Assets

Purchased assets that do not have physical substance but have finite lives (e.g., patents and franchises) are reported on the balance sheet at their fair values, which are reduced over their economic lives by amortization (like depreciation of a physical asset).

Internally developed intangible assets are not reported on the balance sheet. Values of intangible assets that do not have finite lives (e.g., goodwill) and of those that can be renewed at minimal cost (e.g., trademarks) are not amortized, but must be checked periodically for impairment.

Derecognition of Long-Lived Assets

Long-lived assets are *derecognized* and removed from the balance sheet when they are sold, exchanged, or abandoned.

When a long-lived asset is sold, the asset is removed from the balance sheet and the difference between the sale proceeds and the carrying value of the asset is reported as a gain or loss in the income statement. The carrying value is equal to original cost minus accumulated depreciation and any impairment charges.

The gain or loss is usually reported in the income statement as a part of other gains and losses, or reported separately if material. Also, if the firm presents its cash flow statement using the indirect method, the gain or loss is removed from net income to compute cash flow from operations because the proceeds from selling a long-lived asset are an investing cash inflow.

If a long-lived asset is abandoned, the treatment is similar to a sale, except there are no proceeds. In this case, the carrying value of the asset is removed from the balance sheet and a loss of that amount is recognized in the income statement.

If a long-lived asset is exchanged for another asset, a gain or loss is computed by comparing the carrying value of the old asset with fair value of the old asset (or the fair value of the new asset if that value is clearly more evident). The carrying value of the old asset is removed from the balance sheet and the new asset is recorded at its fair value.

Impairments

Under IFRS, the firm must annually assess whether events or circumstances indicate an **impairment** of an asset's value has occurred. For example, there may have been a significant decline in the market value of the asset or a significant change in the asset's physical condition. If so, the asset's value must be tested for impairment.

An asset is impaired when its carrying value (original cost less accumulated depreciation) exceeds the **recoverable amount**. The recoverable amount is the greater of its fair value less any selling costs and its **value in use**. The value in use is the present value of its future cash flow stream from continued use.

If impaired, the asset's value must be written down on the balance sheet to the recoverable amount. An impairment loss, equal to the excess of carrying value over the recoverable amount, is recognized in the income statement.

Under IFRS, the loss can be reversed if the value of the impaired asset recovers in the future. However, the loss reversal is limited to the original impairment loss.

Under U.S. GAAP, an asset is tested for impairment only when events and circumstances indicate the firm may not be able to recover the carrying value through future use.

Determining an impairment and calculating the loss potentially involves two steps. In the first step, the asset is tested for impairment by applying a **recoverability test**. If the asset is impaired, the second step involves measuring the loss.

Recoverability. An asset is considered impaired if the carrying value (original cost less accumulated depreciation) is greater than the asset's future *undiscounted* cash flow stream. Because the recoverability test is based on estimates of future undiscounted cash flows, tests for impairment involve considerable management discretion.

Loss measurement. If impaired, the asset's value is written down to fair value on the balance sheet and a loss, equal to the excess of carrying value over the fair value of the asset (or the *discounted* value of its future cash flows if the fair value is not known), is recognized in the income statement.

Under U.S. GAAP, loss recoveries are not permitted.

Asset Revaluations

Under U.S. GAAP, long-lived assets cannot be revalued upward, except that held-for-sale assets can be revalued upward to the extent of previous impairment writedowns.

Under IFRS, assets may be revalued upward to fair value. Gains reversing previous writedowns are reported on the income statement, and any excess gains are taken as an adjustment to equity in an account called **revaluation surplus**.

The initial effects of upward asset revaluations are to increase assets and stockholders' equity, and net income where gains are taken into income. If a depreciable asset is revalued upward, depreciation will be greater, and income less, in subsequent periods.

Analysis of Long-Lived Assets

An analyst can use financial statement disclosures to estimate the **average age** and **useful life** of a firm's long-lived assets. Older, less-efficient assets may make a firm less competitive. The average age of assets is useful in estimating the timing of major capital expenditures and a firm's future financing requirements. These estimates are most accurate for a firm that uses straight-line depreciation.

$$\text{average age} = \frac{\text{accumulated depreciation}}{\text{annual depreciation expense}}$$

$$\text{total useful life} = \frac{\text{gross PP\&E}}{\text{annual depreciation expense}}$$

$$\text{remaining useful life} = \frac{\text{net PP\&E}}{\text{annual depreciation expense}}$$

Investment Property

Under IFRS (but not U.S. GAAP), property a firm holds for capital appreciation or to collect rental income is classified as *investment property*. Firms can value investment property using either a cost model or a fair value model. Under the fair value model, increases in an asset's carrying value are recognized as gains on the income statement. This differs from the revaluation model for property, plant, and equipment, where an increase in carrying value is recognized in equity as revaluation surplus, unless it reverses a previously recognized loss.

INCOME TAXES

Definitely know this terminology. From the tax return we have:

- *Taxable income*: Income subject to tax as reported on the tax return.
- *Taxes payable*: The tax liability based on taxable income, as shown on the tax return.
- *Income tax paid*: The actual cash outflow for taxes paid during the current period.
- *Tax loss carryforwards*: Losses that could not be deducted on the tax return in the current period but may be used to reduce taxable income and taxes payable in future periods.

On the financial statements, we find *pretax income*, which is income before income tax expense. Pretax income on the income statement is used to calculate:

- *Income tax expense*: A noncash income statement item that includes cash tax expense plus any increase (minus any decrease) in the deferred tax liability minus any increase (plus any decrease) in the deferred tax asset.
- *Deferred income tax expense*: The excess of income tax expense over taxes payable.
- *Valuation allowance*: A contra account that reduces a deferred tax asset for the probability that it will not be realized (U.S. GAAP).

Deferred Tax Liabilities

Deferred tax liabilities are balance sheet amounts that result from an excess of income tax expense over taxes payable and are expected to result in future cash outflows.

The most common reason for creation of a deferred tax liability is that depreciation expense on the income statement (straight-line) is less than depreciation expense on the tax return (accelerated). Pretax income is therefore greater than taxable income, and income tax expense is greater than income tax payable. The taxes that are "deferred" by using accelerated depreciation on the tax return are carried as a deferred tax liability on the balance sheet.

Deferred Tax Assets

Deferred tax assets are balance sheet amounts that result when taxes payable are greater than income tax expense. This results when revenues are recognized for tax prior to their recording on the financial statements, or when expenses for financial reporting are recorded prior to recognizing them as deductible expenses for tax. Prior losses in excess of those that can be used to offset previous income represent a tax-loss carryforward, which is an asset as it will reduce future taxes.

An example of an expense item that can give rise to a deferred tax asset is warranty expense. On the income statement, estimated warranty expense is deductible; on the tax return, only warranty expense actually incurred is deductible. Early on, this leads to taxes payable being greater than income tax expense, which gives rise to a deferred tax asset. In future periods, taxes payable will be less than income tax expense, and the "benefit" of the asset will be realized.

Calculating deferred tax liabilities and assets. Under the liability method, all temporary differences between taxable income and pretax income are multiplied by the expected future tax rate (typically the current rate) to calculate deferred tax assets and liabilities. They are not netted; deferred tax assets and liabilities can be on the balance sheet simultaneously and separately.

Financial analysis. If a company's assets are growing, it may be the case that a deferred tax liability is not expected to reverse in the foreseeable future; an analyst should treat this "liability" as additional equity (decrease the DTL and increase equity). If the liability is expected to reverse, the liability should be adjusted to present value terms to the extent practicable. Decide which is more appropriate on a case-by-case basis.

Tax basis. Gains or losses can result when an asset is sold or a liability is paid when there is a difference between the proceeds or payment and the tax basis of the asset or liability. The tax basis for a long-lived asset is its historical cost minus accumulated tax depreciation. The tax basis for debt is historical proceeds adjusted for the amortization of any original discount or premium to par.

Change in tax rates. A change in tax rates will be reflected by an adjustment to both deferred tax asset and liability accounts. A decrease (increase) in the tax rate will decrease (increase) both deferred tax assets and liabilities; the net change is reflected in income tax expense for the current period.

DTL and DTA Calculations

Consider a firm with a 40% tax rate that has $1,000 in financial statement depreciation and $3,000 of tax return depreciation, as well as $500 of warranty expense that cannot be deducted in the current period for taxes.

The firm will report a DTL of (3,000 − 1,000)(0.40) = $800 and a DTA of (500 − 0)(0.40) = $200. Reported income tax expense is greater than taxes payable by 800 − 200 = $600.

A change in the firm's expected tax rate from 40% to 30% would reduce the DTL to $600 and the DTA to $150. The reduction of $200 in the DTL and the decrease in the DTA of $50 net to a $150 decrease in liabilities, which will reduce reported income tax expense (taxes payable − net deferred tax liability) by $150. Net income/profitability is increased, equity is increased, and leverage is decreased by the change.

Permanent vs. Temporary Differences

So far, our examples have been temporary differences between taxable income and pretax income that will potentially reverse over time. In the case of interest income on tax-exempt bonds, for example, pretax income is greater than taxable income, and this will not reverse. There is no deferred asset or liability created, and the difference is reflected in a difference

between the effective tax rate (income tax expense/pretax income) and the statutory rate on the tax return.

Valuation Allowance

A firm's management must report a valuation allowance, under U.S. GAAP, if it is probable that part or all of a DTA will not be realized because of the firm's inability to generate taxable income in the future. An increase (decrease) in the valuation allowance decreases (increases) the net DTA and reported income. The analyst should examine the reasons for the change as management can manipulate earnings by changing the valuation allowance.

Firms report the details of DTL and DTA changes over the period, as well as a reconciliation of the differences between their effective tax rate (financial statements) and the statutory tax rate (tax return). These details can help an analyst understand the implications of the events that give rise to changes in deferred tax items and better predict future tax rates by considering the factors that caused a difference between the statutory and effective rates.

Some differences in reporting result from the fact that under IFRS upward asset revaluations give rise to DTAs, DTLs and DTAs are netted for reporting purposes, and, rather than reporting a valuation allowance, DTAs are adjusted directly for any probability that they will not be realized (reversed).

NON-CURRENT (LONG-TERM) LIABILITIES

Bonds issued at par:

- *Balance sheet impact*. The value carried on books throughout a bond's life will be equal to face value.
- *Interest expense*. This is always equal to the book value of bonds at the beginning of the period multiplied by the market rate of interest at issuance. With bonds issued at par value, this is the same as the bond's coupon rate.
- *Cash flow*. Cash flow from operations includes a deduction for cash interest expense. Interest expense is equal to the coupon payment. Cash flow from financing is increased by the amount received at issuance and decreased by the payment made when the bonds are redeemed.

Bonds issued at a premium or discount:

- *Balance sheet impact*. Bonds that were originally sold at a premium will always be shown at a premium on the balance sheet. This premium will be amortized toward zero over the life of the bond. Bonds that were originally sold at a discount will always be recorded on the balance sheet at a discount. This discount will be amortized toward zero over the life of the bond. Hence, the book value of both premium and discount bonds will converge to the bond's par or face value at their maturity dates.
- *Interest expense*. In the case of bonds issued at a premium, recorded interest expense will be lower than the coupon payment. Amortization of the bond's premium will serve to reduce the interest expense shown on the income statement. In general, interest expense will equal the coupon payment less the premium amortization. In the case of discount bonds, the interest expense will be higher than the coupon payment. Here, amortization of the bond's discount will serve to increase the interest expense reported

on the income statement. In general, interest expense will equal the coupon payment plus the discount amortization.

- *Cash flow*. For premium bonds, the cash coupon is higher than interest expense. Consequently, CFO is lower and CFF is higher, relative to a company that does not have premium bonds in its capital structure. For discount bonds, the cash coupon is lower than interest expense. Consequently, CFO is higher and CFF is lower, relative to a company that does not have discount bonds.

Debt covenants contained in the bond indenture place restrictions on the firm that protect bondholders and thereby increase the value of the firm's bonds. Typically, such covenants include restrictions on paying common dividends if bond interest is not paid; on the values of specific financial ratios; and on additional debt issuance, acquisitions, mergers, and asset sales.

An analyst can find additional information about a firm's financing liabilities in the footnotes. Typically, disclosures will include the nature of the liabilities, maturity dates, call and conversion provisions, restrictions, collateral pledged as security, and the amount of debt maturing in each of the next five years.

Under both U.S. GAAP and IFRS, recent changes allow firms to report more financial liabilities at fair value. An increase (decrease) in market rates decreases (increases) the present value of the future liability. For analysis, the fair value of liabilities may be more appropriate than amortized historical proceeds as a firm with lower-rate debt is in better financial shape than one that differs only by having higher-rate debt. A downward (upward) adjustment in the value of a firm's liabilities will increase (decrease) its equity and decrease (increase) its leverage ratios.

Derecognition of Debt

When bonds mature, no gain or loss is recognized by the issuer. At maturity, any original discount or premium has been fully amortized; thus, the book value of a bond liability and its face value are the same. The cash outflow to repay a bond is reported in the cash flow statement as a financing cash flow.

A firm may choose to **redeem** bonds before maturity because interest rates have fallen, because the firm has generated surplus cash through operations, or because funds from the issuance of equity make it possible (and desirable).

When bonds are redeemed before maturity, a gain or loss is recognized by subtracting the redemption price from the book value of the bond liability at the reacquisition date. For example, consider a firm that reacquires $1 million face amount of bonds at 102% of par when the carrying value of the bond liability is $995,000. The firm will recognize a loss of $25,000 ($995,000 carrying value − $1,020,000 redemption price). Had the carrying value been greater than the redemption price, the firm would have recognized a gain.

Under IFRS and U.S. GAAP, the initial bond liability on the balance sheet is reduced by issuance costs, which increases the bond's effective interest cost. Under U.S. GAAP, before 2016, issuance costs were capitalized as an asset and allocated to the income statement over the life of the bond. Although the preferred treatment of issuance costs under U.S. GAAP now matches the IFRS treatment, U.S. GAAP still permits the prior treatment.

Any gain or loss from redeeming debt is reported in the income statement, usually as a part of continuing operations, and additional information is disclosed separately. If an asset has been recorded for issuance costs under U.S. GAAP, the unamortized portion is written off at redemption, decreasing any gain or increasing any loss recorded on the income statement. Redeeming debt is usually not a part of the firm's day-to-day operations; thus, analysts often eliminate the gain or loss from the income statement for analysis and forecasting.

When presenting the cash flow statement using the indirect method, any gain (loss) is subtracted from (added to) net income in calculating cash flow from operations. The redemption price is reported as an outflow from financing activities.

Leases

With a lease, a firm (the **lessee**) essentially purchases the right to use an asset from another firm (the **lessor**) for a specified period. Advantages of leasing rather than purchasing an asset may include the following:

- *Less initial cash outflow*. Typically, a lease requires only a small down payment, if any.
- *Less costly financing*. The interest rate implicit in a lease contract may be less than the interest rate on a loan to purchase the asset.
- *Less risk of obsolescence*. At the end of a lease, the lessee often returns the leased asset to the lessor and, therefore, does not bear the risk of an unexpected decline in the asset's end-of-lease value.

To be a lease, a contract must meet the following three requirements:

1. It must refer to a specific asset.
2. It must give the lessee effectively all the asset's economic benefits during the term of the lease.
3. It must give the lessee the right to determine how to use the asset during the term of the lease.

Lessee Financial Reporting

Under IFRS and U.S. GAAP, a **finance lease** is any lease in which both the benefits and risks of ownership are substantially transferred to the lessee. If either the benefits or the risks are not substantially transferred to the lessee, a lease is classified as an **operating lease**. Any given lease will be classified the same way by the lessee and the lessor.

Under IFRS, for both finance and operating leases (except those that are short term or of low value), the lessee records a **right-of-use (ROU) asset** and a **lease liability** on the balance sheet, both equal to the present value of the lease payments. The ROU asset is amortized straight-line over the term of the lease. The amortization amount and the interest portion of each lease payment are reported (separately) as expenses on the income statement. The lease liability is reduced each period by the principal portion of the lease payment. So, while the asset and liability both begin with the same value and reach zero at the end of the lease, their values can differ during the life of the lease, as the principal portion of the lease payment will exceed the amortization of the ROU asset in the early years of a lease.

Under U.S. GAAP, a lessee accounts for finance leases just as under IFRS. With an operating lease, the lessee reports both the interest portion of the lease payment and the amortization of the ROU asset (which is equal to the interest portion of the lease payment, not straight-line as under IFRS) on the income statement as a single expense. Because the amortization of the lease liability and the amortization of the ROU asset are equal each period, the asset and liability will have equal values over the life of the lease.

For all leases under IFRS, the principal portion of the lease payment is a financing cash outflow, while the interest portion may be reported as an operating or financing cash outflow. Under U.S. GAAP, for a finance lease, the interest portion of the lease payment is an operating cash outflow and the principal portion is a financing cash outflow. For an operating lease under U.S. GAAP, the full lease payment is classified as an operating cash outflow.

Lessor Financial Reporting

For lessors, the financial reporting of both finance and operating leases is the same under IFRS and U.S. GAAP.

Finance lease. At initiation, the lessor removes the leased asset from its balance sheet and adds a **lease receivable** asset equal to the present value of the expected lease payments. If this value is different from the asset's book value, the lessor recognizes a gain or a loss. Over the term of the lease, the lessor uses the effective interest method (the same as lessees) to amortize the lease receivable and reports the interest portion of the lease payments as income. If leasing is one of the lessor's primary business activities, this interest income is included in revenues for the period. The entire cash inflow (interest and principal) is classified as cash from operations.

Operating lease. The lessor keeps the leased asset on its balance sheet and continues to record depreciation expense. On the income statement, the lessor reports the lease payments as income and reports depreciation and other costs associated with leasing the asset as expenses. As with a finance lease, the entire cash inflow is cash from operations.

Pension Plans

A **defined contribution plan** is a retirement plan in which the firm contributes a sum each period to the employee's retirement account. The firm makes no promise to the employee regarding the future value of the plan assets. The investment decisions are left to the employee, who assumes all of the investment risk. On the income statement, pension expense is simply equal to the employer's contribution. There is no future liability to report on the balance sheet.

In a **defined benefit plan**, the firm promises to make periodic payments to employees after retirement. The benefit is usually based on the employee's years of service and the employee's compensation at, or near, retirement. For example, an employee might earn a retirement benefit of 2% of her final salary for each year of service. Because the employee's future benefit is defined, the employer assumes the investment risk.

Financial reporting for a defined benefit plan is much more complicated than for a defined contribution plan because the employer must estimate the value of the future obligation to its employees. The obligation involves forecasting a number of variables, such as future

compensation levels, employee turnover, retirement age, mortality rates, and an appropriate discount rate.

For defined benefit plans, if the fair value of the plan's assets is greater than the estimated pension liability, the plan is said to be **overfunded** and the sponsoring firm records a **net pension asset** on its balance sheet. If the fair value of the plan's assets is less than the estimated pension liability, the plan is **underfunded** and the firm records a **net pension liability** on its balance sheet.

The change in the net pension asset or liability is reported each year. Some components of the change are included in net income while others are included in other comprehensive income.

FINANCIAL REPORTING QUALITY

When discussing the quality of a firm's financial statements, we must distinguish between the quality of its financial reporting and the quality of its reported results.

Financial reporting quality refers to the characteristics of a firm's financial statements, primarily with respect to how well they follow generally accepted accounting principles (GAAP). However, given that GAAP allow choices among methods, estimates, and specific treatments, compliance with GAAP by itself does not necessarily produce financial reporting of the highest quality.

High-quality financial reporting must be *decision-useful*. Two characteristics of decision-useful financial reporting are *relevance* and *faithful representation*. Financial statements are relevant when the information presented is useful in making decisions and likely to affect these decisions. Faithful representation encompasses the qualities of completeness, neutrality, and the absence of errors.

The **quality of earnings** is a separate issue. The quality of reported earnings (not the quality of earnings reports) is high if earnings represent an adequate return on equity and are sustainable; that is, they are expected to recur in future periods. A firm can have high financial reporting quality but low earnings quality (inadequate returns/unsustainable), but if a firm has low-quality financial reporting, we might not be able to determine the quality of its earnings.

Quality of financial reports may be ranked from best to worst, based on the quality of earnings and financial reporting:

1. Reporting is compliant with GAAP and decision-useful; earnings are sustainable and adequate.
2. Reporting is compliant with GAAP and decision-useful, but earnings are not sustainable or not adequate.
3. Reporting is compliant with GAAP, but earnings quality is low and reporting choices and estimates are biased.
4. Reporting is compliant with GAAP, but the amount of earnings is actively managed to increase, decrease, or smooth reported earnings.
5. Reporting is not compliant with GAAP, although the numbers presented are based on the company's actual economic activities.

6. Reporting is not compliant and includes numbers that are fictitious or fraudulent.

Neutral Accounting vs. Conservative or Aggressive Accounting

Financial statements should be neutral (unbiased) to be most valuable to users. Biased reporting can be conservative or aggressive. Choices made within GAAP are considered **conservative** if they tend to decrease the company's reported earnings and financial position for the current period and considered **aggressive** if they increase reported earnings or improve the financial position for the current period. Aggressive accounting often results in decreased earnings in future periods, while conservative accounting will tend to increase future period earnings.

Both these types of bias are used by management to **smooth earnings**. During periods of higher-than-expected (or higher than a specific benchmark) earnings, management may employ a conservative bias (e.g., by adjusting an accrued liability upward to reduce reported earnings for that period). This effectively defers the recognition of these earnings to a future period. If, in a future period, earnings are less than expected, a more aggressive earnings choice (e.g., decreasing the accrued liability) can increase reported earnings. The initial increase in the accrued liability is sometimes referred to as putting earnings in the "cookie jar" (so that they may be enjoyed later).

Conservatism in financial reporting is not necessarily "good." Either type of bias is a deviation from neutral reporting or faithful representation. Sometimes GAAP themselves can introduce conservatism by imposing higher standards of verification for revenue and profit than for expenses and accrual of liabilities. While conservative bias is not ideal for users of financial statements, it may be beneficial in reducing the probability of future litigation from users claiming they were misled, in reducing current period tax liability, and in protecting the interests of those who have less complete information than management, such as buyers of the company's debt.

Some examples of conservative versus aggressive financial reporting choices are shown in Figure 3.

Figure 3: Aggressive and Conservative Accounting

Aggressive	Conservative
Capitalize current period costs	Expense current period costs
Longer estimates of the lives of depreciable assets	Shorter estimates of the lives of depreciable assets
Higher estimated salvage values	Lower estimated salvage values
Straight-line depreciation	Accelerated depreciation
Delayed recognition of impairments	Early recognition of impairments
Smaller reserve for bad debt	Greater reserve for bad debt
Smaller valuation allowances on deferred tax assets	Larger valuation allowances on deferred tax assets

Motivations and Conditions for Low-Quality Financial Reporting

Three factors that typically exist in cases where management provides low-quality financial reporting are *motivation*, *opportunity*, and *rationalization* of the behavior.

One important motivation for aggressive accounting choices is to meet or exceed benchmark or expected earnings per share growth. The manager's motivation may be to enhance her reputation and improve future career opportunities or to simply increase incentive compensation. Other possible motivations are to gain credibility with equity market investors or improve the way the company is viewed by its customers and suppliers. For companies that are highly leveraged and unprofitable, aggressive accounting may be motivated by a desire to avoid violating debt covenants.

Circumstances that provide opportunity for low-quality, or even fraudulent, financial reporting include weak internal controls, inadequate oversight by the board of directors, the large range of acceptable accounting treatments, or inconsequential penalties in the case of accounting fraud.

The third likely factor in low-quality financial reporting is rationalization by management for less-than-ethical actions. Whether the story is "I'll fix it next period" or "I have to do it to get my bonus and pay for my parents' care," the resulting behavior is the same.

Requiring audited financial statements is one mechanism to discipline financial reporting quality. However, an unqualified or "clean" audit opinion does not guarantee that no fraud has occurred; it only offers reasonable assurance that the financial statements (prepared the under the direction of management) have been "fairly reported" with respect to the applicable GAAP. The auditor is selected and paid by the firm being audited.

Non-GAAP Measures

Firms will sometimes report accounting measures that are not defined or required under GAAP. Such measures typically exclude some items in order to make the firm's performance look better. Management may exclude items because they are one-time or nonoperating costs that will not affect operating earnings going forward, because the items are non-cash charges, or to "improve comparability with companies that use different accounting methods" for depreciation or restructuring charges.

In the United States, companies that report non-GAAP measures in their financial statements are required to:

- Display the most comparable GAAP measure with equal prominence.
- Provide an explanation by management as to why the non-GAAP measure is thought to be useful.
- Reconcile the difference between the non-GAAP measure and the most comparable GAAP measure.
- Disclose other purposes for which the firm uses the non-GAAP measure.
- Include, in any non-GAAP measure, any items that are likely to recur in the future, even those treated as nonrecurring, unusual, or infrequent in the financial statements.

IFRS require that firms using non-IFRS measures in financial reports must:

- Define and explain the relevance of such non-IFRS measures.
- Reconcile the differences between the non-IFRS measure and the most comparable IFRS measure.

Accounting Methods, Choices and Estimates, and Warning Signs

Revenue recognition. Firms can choose where in the shipping process the customer takes title to the goods: free-on-board (FOB) at the shipping point or FOB at the destination. Choosing terms of FOB at the shipping point will mean that revenue is recognized earlier compared to FOB at the destination.

Firms can also manage the timing of revenue recognition by accelerating or delaying shipments. If additional revenue is required to meet targets, firms can offer discounts or special financing terms to increase orders in the current period or ship goods to distributors without receiving an order. Overloading a distribution channel with more goods than would normally be sold during a period is referred to as **channel stuffing**. In periods when high earnings are expected, management may wish to delay recognition of revenue to the next period and hold or delay customer shipments to achieve this.

In a **bill-and-hold transaction**, the customer buys the goods and receives an invoice but requests that the firm keep the goods at their location for a period of time. The use of fictitious bill-and-hold transactions can increase earnings in the current period by recognizing revenue for goods that are actually still in inventory. Revenue for future periods will be decreased as real customer orders for these bill-and-hold items are filled but not recognized in revenue, offsetting the previous overstatement of revenue.

Accounting warning signs related to revenue recognition may include:

- Changes in revenue recognition methods.
- Use of barter transactions.
- Use of rebate programs that require estimation of the impact of rebates on net revenue.
- Lack of transparency with regard to how the various components of a customer order are recorded as revenue.
- Revenue growth out of line with peer companies.
- Receivables turnover is decreasing over multiple periods.
- Decreases in total asset turnover, especially when a company is growing through acquisition of other companies.
- Inclusion of nonoperating items or significant one-time sales in revenue.

Estimates of credit losses. On the balance sheet, the reserve for uncollectible debt is an offset to accounts receivable. If management determines the probability that accounts receivable will be uncollectible is lower than their current estimate, a decrease in the reserve for uncollectible debt will increase net receivables and increase net income. An increase in the estimate of credit losses would have the opposite effect.

A firm that simply underestimates the percentage of receivables that will be uncollectible will report higher receivables and higher net income as a result. At some point, when

actual uncollectible accounts exceed the low estimate, the firm will report an additional expense that will reduce net income and net receivables.

Other reserves, such as a reserve for warranty expense, can also be changed to manage reported earnings. A decrease in the estimated warranty expense as a percentage of sales will increase earnings, while an increase in the reserve for warranty expense will decrease earnings.

Valuation allowance. Recall that, under U.S. GAAP, a valuation allowance reduces the carrying value of a deferred tax asset based on managers' estimates of the probability it will not be realized. Similar to the effects of an allowance for bad debt, increasing a valuation allowance will decrease the net deferred tax asset on the balance sheet and reduce net income for the period, while a decrease in the valuation allowance will increase the net deferred tax asset and increase net income for the period. The valuation allowance can be understated to show higher asset values, and it can be adjusted over time to smooth earnings. Under IFRS, while no explicit valuation allowance is reported, deferred tax assets (and liabilities) are adjusted to the expected recoverable amount.

Depreciation methods and estimates. Compared to straight-line depreciation, an accelerated depreciation method increases expenses and decreases net income in the early years of an asset's life. In the later years of an asset's life, this will reverse; expenses will be lower, and net income will be higher.

Estimates of useful life and salvage value can also affect depreciation expense and, thereby, net income and the carrying value of an asset. An increase in salvage value will decrease depreciation expense, increase operating income, and result in a greater carrying value for the asset. A smaller salvage value will have the opposite effects. If the salvage value of an asset is set higher than the actual sale price at the end of the asset's life, a loss on the sale of the asset will decrease net income in the period in which the asset is disposed of. Using a longer estimated useful life decreases periodic depreciation expense and increases net income in the early years of an asset's life compared to using a shorter estimated useful life.

Depreciation methods, estimated asset lives, or estimates of salvage values that are out of line with those of peer companies in the industry are an accounting warning sign.

Amortization and impairment. Management choices and estimates regarding amortization of purchased intangible assets are similar to those for depreciation of tangible assets. The intangible asset goodwill is not amortized but is subject to an impairment test. By ignoring or delaying recognition of an impairment charge for goodwill, management can increase earnings in the current period.

Inventory method. During periods of rising prices, cost of goods sold (COGS) under the FIFO method will be less than COGS under the weighted-average costing method. Gross profit, gross margin, and earnings will all be greater under the FIFO method than under the weighted-average method as a result. Balance sheet inventory value will be greater under FIFO than under the weighted-average method. During periods of decreasing prices, the opposite is true.

FIFO results in more accurate balance sheet inventory values because inventory value is closer to current replacement cost than under the weighted-average cost or LIFO method. Conversely, COGS are closer to current (replacement) cost under the LIFO and weighted-

average cost method so that gross and net margins better reflect economic reality under those methods.

Accounting warning signs related to inventories may include a declining inventory turnover ratio or, for a firm using LIFO under U.S. GAAP, drawing down inventory levels so that COGS reflects the lower costs of items acquired in past periods, which increases current period earnings.

Related-party transactions. If a public firm does business with a supplier that is private and controlled by management, adjusting the price of goods supplied can shift profits either to or from the private company to manage the earnings reported by the public company.

Capitalizing expenses. Any expense that can be capitalized creates an asset on the balance sheet, and the impact of the expense on net income can be spread over many years. Capitalization also affects cash flow classifications. If an expense is capitalized, the entire amount is classified as an investing cash outflow so that operating cash flow is increased by that amount. Analysts should take notice if a firm capitalizes costs that are not typically capitalized by firms in their industry.

Capitalizing interest expense will decrease cash flow from investing and increase cash flow from operations, along with its effects on the pattern of earnings from depreciating the interest expense over time rather than expensing it all in the current period. The ability under IFRS to classify interest received and dividends received as either operating or investing cash flows, and interest paid and dividends paid as either operating or financing cash flows, gives management some ability to manage reported operating cash flow.

Stretching payables. Delaying payments that would normally be made near the end of a reporting period until the beginning of the next accounting period will increase operating cash flow in the current period and reduce it in some subsequent period. There is no effect on reported earnings in the current period from stretching payables.

Other accounting warning signs:

- The ratio of operating cash flow to net income is persistently less than one or declining over time.
- Fourth-quarter earnings show a pattern (either high or low) compared to the seasonality of earnings in the industry or seasonality of revenue for the firm.
- Certain expenses are classified as nonrecurring but appear regularly in financial reports.
- Gross or operating profit margins are noticeably higher than are typical for the industry and peer companies.
- Management typically provides only minimal financial reporting information and disclosure.
- Management typically emphasizes non-GAAP earnings measures and uses special or nonrecurring designations aggressively for charges.
- Growth by purchasing a large number of businesses can provide many opportunities to manipulate asset values and future depreciation and amortization and make comparisons to prior period earnings problematic.

APPLICATIONS OF FINANCIAL STATEMENT ANALYSIS

These applications include the use of common-size financial statements and other ratio analysis to evaluate past performance, prepare projections of future earnings, assess credit quality, and screen for equity investments; and adjusting financial statements to facilitate comparison between companies.

Analysis Based on Ratios

Trends in financial ratios and differences between a firm's financial ratios and those of its competitors or industry averages can indicate important aspects of a firm's business strategy and whether a strategy is succeeding. Some examples of interpreting ratios are:

- Premium and custom products are usually sold at higher gross margins than less differentiated commodity-like products, so we should expect cost of goods sold to be a higher proportion of sales for the latter.
- We might also expect a company with products that have cutting-edge features and high quality to spend a higher proportion of sales on research and development. This proportion may be quite low for a firm purchasing components from suppliers rather than developing new features and capabilities in-house.
- The ratio of gross profits to operating profits will be larger for a firm that has relatively high research and development and/or advertising expenditures.
- If a firm claims it will improve earnings per share by cutting costs, examination of operating ratios and gross margins over time will reveal whether the firm has actually been able to implement such a strategy.

Forecasting Financial Performance for a Firm

A forecast of future net income and cash flow often begins with a forecast of future sales based on the top-down approach (especially for shorter horizons).

- Begin with a forecast of GDP growth, often supplied by outside research or an in-house economics group.
- Use historical relationships to estimate the relationship between GDP growth and the growth of industry sales.
- Determine the firm's expected market share for the forecast period, and multiply by industry sales to forecast firm sales.
- In a simple forecasting model, some historical average or trend-adjusted measure of profitability (operating margin, EBT margin, or net margin) can be used to forecast earnings.
- In complex forecasting models, each item on an income statement and balance sheet can be estimated based on separate assumptions about its growth in relation to revenue growth.
- For multi-period forecasts, the analyst typically employs a single estimate of sales growth at some point that is expected to continue indefinitely.

- To estimate cash flows, the analyst must make assumptions about future sources and uses of cash, especially as regards changes in working capital, capital expenditures on new fixed assets, issuance or repayments of debt, and issuance or repurchase of stock.
- A typical assumption is that noncash working capital as a percentage of sales remains constant.
- A first-pass model might indicate a need for cash in future periods, and these cash requirements can then be met by projecting necessary borrowing in future periods. For consistency, interest expense in future periods must also be adjusted for any increase in debt and reflected in the income statement, which must be reconciled with the pro forma balance sheet by successive iterations.

Role of Financial Statement Analysis in Assessing Credit Quality

The three Cs of credit analysis are:

1. **Character:** *Character* refers to firm management's professional reputation and the firm's history of debt repayment.
2. **Collateral:** The ability to pledge specific *collateral* reduces lender risk.
3. **Capacity:** The *capacity* to repay requires close examination of a firm's financial statements and ratios. Since some debt is for periods of 30 years or longer, the credit analyst must take a very long-term view of the firm's prospects.

Credit rating agencies, such as Moody's and Standard and Poor's, use items to assess firm creditworthiness that can be separated into four general categories:

1. *Scale and diversification*. Larger companies and those with more different product lines and greater geographic diversification are better credit risks.
2. *Operational efficiency*. Such items as operating ROA, operating margins, and EBITDA margins fall into this category. Along with greater vertical diversification, high operating efficiency is associated with better debt ratings.
3. *Margin stability*. Stability of the relevant profitability margins indicates a higher probability of repayment (leads to a better debt rating and a lower interest rate). Highly variable operating results make lenders nervous.
4. *Leverage*. Ratios of operating earnings, EBITDA, or some measure of free cash flow to interest expense or total debt make up the most important part of the credit rating formula. Firms with greater earnings in relation to their debt and in relation to their interest expense are better credit risks.

Screening for Potential Equity Investments

In many cases, an analyst must select portfolio stocks from the large universe of potential equity investments. Accounting items and ratios can be used to identify a manageable subset of available stocks for further analysis.

Criteria commonly used to screen for attractive equity investments include low P/E, P/CF or P/S; high ROE, ROA, or growth rates of sales and earnings; and low leverage. Multiple

criteria are often used because a screen based on a single factor can include firms with other undesirable characteristics.

Analysts should be aware that their equity screens will likely include and exclude many or all of the firms in particular industries.

Financial Statement Adjustments to Facilitate Comparisons

Differences in accounting methods chosen by firms subject to the same standards, as well as differences in accounting methods due to differences in applicable accounting standards, can make comparisons between companies problematic. An analyst must be prepared to adjust the financial statements of one company to make them comparable to those of another company or group of companies.

Common adjustments required include adjustment for:

- Differences in depreciation methods and assumptions.
- Differences in inventory cost flow assumptions/methods.
- Differences in the treatment of the effect of exchange rate changes.
- Differences in classifications of investment securities.
- Capitalization decisions.
- Goodwill.

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[1] Hennie Van Greunung and Sonja Brajovic Bratanovic, *Analyzing and Managing Banking Risk: Framework for Assessing Corporate Governance and Financial Risk*, International Bank for Reconstruction and Development, April 2003, p. 300.

[2] *Conceptual Framework for Financial Reporting (2010)*. paragraphs QC5-18.

CORPORATE ISSUERS

Weight on Exam	8% to 12%
SchweserNotes™ Reference	Book 3, Pages 1–104

CORPORATE STRUCTURES AND OWNERSHIP

Key features of **business structures** include the legal relationship between the business and its owners; the relationship between its owners and operators; whether the owners' liability is limited or unlimited; and the tax treatment of profits and losses.

Common business structures include:

- **Sole proprietorship:** An individual owns and operates a business. The owner has unlimited liability and the only claim on profits from the business, and is solely responsible for taxes.
- **General partnership:** Two or more individuals own and operate a business. Partners have unlimited liability. A partnership agreement states each partner's responsibilities for business operations and their shares of the partnership's profits or losses. Each partner's share of the profits is taxed as personal income.
- **Limited partnership:** General partners operate a business and have unlimited liability, while limited partners are liable only for the amount they invest. General partners typically receive a larger portion of the profits than limited partners. Profits are taxed as personal income to each partner.
- **Corporation:** A legal entity separate from its owners and operators. All owners have limited liability. Owners (shareholders) are separate from operators (managers) and appoint a board of directors to hire the managers. Profits may be subject to **double taxation** if a country taxes companies on their earnings and shareholders on dividends.

Corporations can be for-profit or not-for-profit. The purpose of a **not-for-profit corporation** is to produce a social benefit or pursue a charitable goal. It must reinvest any profits it generates toward its mission and is typically exempt from tax.

For-profit corporations may be public or private. A **public corporation** may be defined as having shares that trade in an organized market or having at least a minimum number of owners. A **private corporation** is one that does not qualify as public. Differences between public and private companies include how they issue shares, how owners can transfer shares, and disclosure requirements.

A company can become public by issuing shares in an **initial public offering (IPO)**. After an IPO, its shares trade on an exchange and owners can buy and sell them without dealing directly with the company. Other ways a company can become public include being acquired by a public company, which may be an existing concern or a **special purpose acquisition company**, or by carrying out a **direct listing** on a stock exchange.

A public company may become private through a **leveraged buyout (LBO)**, in which outside investors buy all of the company's outstanding shares and delist them from the exchange, or a **management buyout (MBO)**, in which the company's managers do so.

A private company can sell shares to **accredited investors**, typically institutions or high net worth individuals, in a **private placement**, without becoming a public corporation.

Regulators require public companies to report their financial results periodically and disclose other relevant information. Private companies are not subject to these requirements.

Claims of Lenders and Owners

The interests of a company's lenders, or debt holders, may conflict with the interests of its owners, or equity holders. Lenders have a higher priority of claims than owners to a company's net assets. Lenders have a legal claim to the interest and principal payments the company has promised, while owners have a residual claim to what remains after the company pays its lenders and all other claims.

While both lenders and owners can potentially lose their entire investment if a company fails, their upside potential differs. The best result lenders can get is to receive their promised interest and principal. As long as a company can repay its obligations, its growth does not benefit lenders.

Owners have theoretically unlimited upside if a company succeeds and grows. As a result, owners may favor actions that increase a company's potential growth but also increase its risk. Lenders may oppose such actions because they increase the lenders' default risk but do not increase their upside.

INTRODUCTION TO CORPORATE GOVERNANCE AND OTHER ESG CONSIDERATIONS

Corporate governance refers to the internal controls and procedures for managing companies.

Under **shareholder theory**, the primary focus of a system of corporate governance is the interests of the firm's shareholders, which are taken to be the maximization of the market value of the firm's common equity. Under **stakeholder theory**, the focus is broader, considering conflicts among groups such as shareholders, employees, suppliers, and customers.

Stakeholder Groups

- *Shareholders* have an interest in the ongoing profitability and growth of the firm, both of which can increase the value of their ownership shares.
- The *board of directors* has a responsibility to protect the interests of shareholders.
- *Senior managers* have interests that include continued employment and maximizing the total value of their compensation.
- *Employees* have an interest in their rate of pay, opportunities for career advancement, training, and working conditions.

- *Creditors* supply debt capital to the firm. The interests of creditors are protected to varying degrees by covenants in the firm's debt agreements.
- *Suppliers* have an interest preserving an ongoing relationship with the firm, in the profitability of their trade with the firm, and in the growth and ongoing stability of the firm. As they are typically short-term creditors, they also have an interest in the firm's solvency.

Potential Conflicts Among Stakeholder Groups

The **principal-agent conflict** arises because an agent is hired to act in the interest of the principal, but an agent's interests may not coincide exactly with those of the principal. In the context of a corporation, shareholders are the principals (owners), and firm management and board members (directors) are their agents.

Managers and directors may choose a lower level of business risk than shareholders would. This conflict can arise because the risk of company managers and directors is more dependent on firm performance than the risk of shareholders because shareholders may hold diversified portfolios of stocks and are not dependent on the firm for employment.

There is an **information asymmetry** between shareholders and managers because managers have more information about the functioning of the firm and its strategic direction than shareholders do. This decreases the ability of shareholders or non-executive directors to monitor and evaluate whether managers are acting in the best interests of shareholders.

Conflicts between groups of shareholders. A single shareholder or group of shareholders may hold a majority of the votes and act against the interests of the minority shareholders. Some firms have different classes of common stock outstanding, some with more voting power than others. A group of shareholders may have effective control of the company although they have a claim to less than 50% of the earnings and assets of the company.

In an acquisition of the company, controlling shareholders may be in a position to get better terms for themselves relative to minority shareholders. Majority shareholders may cause the company to enter into **related-party transactions** that benefit entities in which they have a financial interest, to the detriment of minority shareholders.

Conflicts between creditors and shareholders. Shareholders may prefer more business risk than creditors do because creditors have a limited upside from good results compared to shareholders. Equity owners could also act against the interests of creditors by issuing new debt that increases the default risk faced by existing debt holders or by the company paying greater dividends to equity holders, thereby increasing creditors' risk of default.

Conflicts between shareholders and other stakeholders. The company may decide to raise prices or reduce product quality to increase profits, to the detriment of customers. The company may employ strategies that significantly reduce the taxes they pay to the government.

Managing Stakeholder Relationships

Shareholder Mechanisms

Corporations typically hold an **annual general meeting** after the end of the firm's fiscal year. A shareholder who does not attend the annual general meeting can vote her shares by **proxy**. A proxy may specify the shareholder's vote on specific issues or leave the vote to the discretion of the person to whom the proxy is assigned.

Ordinary resolutions, such as approval of auditor and the election of directors, require a simple majority of the votes cast. Other resolutions, such as those regarding a merger or takeover, or that require amendment of corporate bylaws, are termed **special resolutions** and may require a supermajority vote for passage, typically two-thirds or three-fourths of the votes cast. Such special resolutions can also be addressed at an **extraordinary general meeting**, which can be called anytime there is a resolution about a matter that requires a vote of the shareholders.

With **majority voting**, the candidate with the most votes for each single board position is elected. With **cumulative voting**, shareholders can cast all their votes (shares times the number of board position elections) for a single board candidate or divide them among board candidates. Cumulative voting can result in greater minority shareholder representation on the board compared to majority voting.

Activist shareholders pressure companies for changes they believe will increase shareholder value. They may seek representation on the board of directors, propose shareholder resolutions, or initiate shareholder lawsuits.

A group may initiate a **proxy fight**, in which the group seeks the proxies of shareholders to vote in favor of its alternative proposals and policies. An activist group may make a **tender offer** for a specific number of shares of a company to gain enough votes to take over the company.

Senior managers and boards of directors can be replaced by shareholders. The threat of a **hostile takeover** can act as an incentive to influence company managements and boards to pursue policies oriented toward increasing shareholder value.

Board of Directors and Management Mechanisms

A board of directors typically has committees made up of board members with particular expertise. These committees report to the board, which retains the overall responsibility for the various board functions. The following are examples of typical board committees.

An **audit committee** oversees the financial reporting function and the implementation of accounting policies, monitors the effectiveness of the company's internal controls and internal audit function, recommends an external auditor, and proposes remedies based on its review of internal and external audits.

A **governance committee** is responsible for overseeing the company's corporate governance code, implementing the company's code of ethics, and monitoring changes in laws and regulations and ensuring that the company is in compliance.

A **nominations committee** proposes qualified candidates for election to the board, manages the search process, and attempts to align the board's composition with the company's corporate governance policies.

A **compensation committee** or **remuneration committee** recommends to the board the amounts and types of compensation to be paid to directors and senior managers. This

committee may also be responsible for oversight of employee benefit plans and evaluation of senior managers.

A **risk committee** informs the board about appropriate risk policy and risk tolerance of the organization and oversees its risk management processes. An **investment committee** reviews management proposals for large acquisitions or projects, sale or other disposal of company assets or segments, and the performance of acquired assets and other large capital expenditures. Some companies combine these two functions into one committee.

Creditor mechanisms. When a company issues a bond, a legal document called a **bond indenture** includes covenants that may require the company to take certain actions or prohibit the company from taking certain actions. A financial institution may act as a trustee to monitor the company's compliance with its bond covenants. In some countries, when a company files for bankruptcy, a creditor committee is created to represent the interests of unsecured creditors (especially bondholders) throughout the bankruptcy process.

Employee, customer, and supplier mechanisms. For customers and suppliers, contracts are the primary mechanism for managing relationships with companies. For employees, labor laws, employment contracts, and unions are the primary mechanisms to manage relationships with employers.

Government mechanisms. Governments enact and enforce regulations that govern companies' actions. Shareholders' and creditors' interests are considered to be better protected in countries with a common-law system under which judges' rulings become law in some instances, as compared with a civil law system, under which judges rule based only on specifically enacted laws.

Risks of Poor Governance

When corporate governance is weak, the control functions of audits and board oversight may be weak as well. The risk is that some stakeholders can gain an advantage, to the disadvantage of other stakeholders. Accounting fraud, or simply poor recordkeeping, will have negative implications for company performance and value.

Without proper monitoring and oversight, management may have incentive compensation that causes it to pursue its own benefit rather than the company's benefit. If management is allowed to engage in related-party transactions that benefit friends or family, this will decrease company value.

Poor compliance procedures with respect to regulation and reporting can easily lead to legal and reputational risks. Violating stakeholder rights can lead to stakeholder lawsuits. A company's reputation can be damaged by failure to comply with governmental regulations. Failure to manage creditors' rights can lead to debt default and bankruptcy.

Benefits of Effective Governance

Effective governance implies effective control and monitoring. A strong system of controls and compliance with laws and regulations can avoid many legal and regulatory risks.

Formal policies regarding conflicts of interest and related party transactions can also lead to better operating results. Alignment of management interests with those of shareholders

leads to better financial performance and greater company value.

Environmental, Social, and Governance (ESG) Investment Considerations

The use of environmental, social, and governance factors in making investment decisions is referred to as **ESG investing**. Terms related to ESG investing include:

- **Responsible investing:** A broad term for considering ESG factors in investment decisions.
- **Sustainable investing:** Investing in companies or industries based on the perceived sustainability of their output.
- **Socially responsible investing:** Choosing investments based on the investor's moral or social values.

ESG considerations and fiduciary responsibilities to clients may conflict. Constructing a portfolio based on ESG factors at the expense of investor returns would violate fiduciary duty, unless client directed. On the other hand, failing to consider risks from negative ESG factors may also violate fiduciary duty.

Approaches to Integrating ESG Factors Into Portfolio Management

Negative screening refers to excluding specific companies or industries from consideration for the portfolio based on their practices regarding human rights, environmental concerns, or corruption.

Positive screening attempts to identify companies that have positive ESG practices such as environmental sustainability, employee rights and safety, and overall governance practices. A related approach, the **relative/best-in-class approach**, seeks to identify companies within each industry group with the best ESG practices.

Full integration refers to including ESG factors or scores in traditional fundamental analysis.

Thematic investing refers to investing in sectors or companies in an attempt to promote specific ESG-related goals.

Engagement/active ownership investing refers to using ownership of company shares or other securities as a platform to promote improved ESG practices.

Green finance refers to producing economic growth in a more sustainable way by reducing emissions and better management of natural resources.

Green bonds are securities issued to raise funds for projects with a positive environmental impact.

Business Models & Risks

A **business model** explains how a firm provides or proposes to provide a product or service, find customers, deliver the product or service, and make a profit. It differs from a **financial plan**, which has detailed projections for revenue and expenses. A business model should identify a firm's potential customers, describe its products or services and explain how it will sell them, describe its key assets and suppliers, and explain its pricing strategy.

Potential customers can be defined in innumerable ways. A business model should identify how the company will acquire customers, the cost of acquiring them, and how the company will monitor and maintain customer satisfaction.

Describing a product or service includes how a company meets a need for its potential customers and what differentiates it from its competitors' products or services. A firm's **value proposition** refers to how customers will value the characteristics of the product or service, given its competing products and their prices. The firm's **value chain** refers to how it executes its value proposition.

How the firm will sell its product or service includes whether it will sell directly to buyers or use intermediaries, as well as how it will deliver its product or service. The answers to these questions comprise a firm's **channel strategy**. A company is a **B2B (business to business)** firm if it sells to other businesses, or a **B2C (business to consumer)** firm if it sells to consumers.

Pricing Strategies

Value-based pricing refers to setting prices based on the value perceived by the buyer. **Cost-based pricing** refers to setting prices based on the costs of producing the firm's goods or services, plus a profit.

Price discrimination refers to setting different prices for different customers. This can be driven by different demand from identifiable groups (e.g., discounts for senior citizens) or by different costs of providing goods or services. Other examples are **tiered pricing** based on the volume of purchases, **dynamic pricing** such as peak (surge or congestion) pricing, and **auction pricing**.

Pricing models for multiple products include **bundling** (when multiple products are complementary), **razors-and-blades** (selling a piece of equipment for a low price and profiting by selling a consumable used with the equipment), or **optional products** (add-ons priced with high margins).

Other pricing models include **penetration pricing** (selling at low margins for a time to grow market share), **freemium pricing** (offering basic functionality at no cost, but unlocking more functionality for a fee), or **hidden revenue** (such as offering online content for free but generating revenue through advertising or selling user data).

Pricing models that are alternatives to outright purchase include subscriptions, fractional ownership (e.g., time-share arrangements), licensing, and franchising.

External Environment and Financing Needs

A firm's overall risk, and therefore its cost of debt and equity capital, depends on its business model as well as firm-specific and external risk factors. External factors that can affect business risk include economic conditions, demographics, regulation, and the political and legal environment. Internal risk factors include a firm's life cycle stage and vulnerability to competition. Business models that involve renting or leasing major assets require less capital than models that involve owning major assets.

Macro risk arises from economic, political, and legal risk factors, as well as other risks such as demographic changes over time. The main macro risk for many companies is economic

slowdown or recession. We refer to companies as cyclical or non-cyclical depending on how strongly correlated their revenues and earnings are with economic growth.

Business risk refers to the variability of operating income that arises from firm-specific and industry-specific factors. Industry risk factors include cyclicality, concentration and competitive intensity, dynamics within the value chain, growth and demand expectations, and regulatory risks. Firm-specific risk factors include competitive risks such as erosion of competitive advantages; product market risk such as changes in consumer tastes; capital investment risk such as acquisitions that do not produce returns above the firm's cost of capital; or ESG-related risks.

CAPITAL INVESTMENTS

Capital investments include **business maintenance investments** (going concern projects and regulatory/compliance projects) and **business growth investments** (expansion projects and other new investments).

- **Going concern projects** may be needed to maintain the business or reduce costs. Projects to maintain the business typically do not require detailed analysis, but projects to improve efficiency may require it.
- **Regulatory/compliance projects** may be required and often involve safety-related or environmental concerns.
- **Expansion projects** grow the business and involve complex analysis because they require a forecast of future demand.
- Other projects, such as new investments outside a company's existing lines of business, also entail a complex decision-making process.

The **capital allocation process** involves identifying and evaluating projects for which the cash flows to the firm extend over a period longer than one year. The process has four steps:

1. Generating ideas.
2. Analyzing project proposals.
3. Creating the firm's capital budget.
4. Monitoring decisions and conducting a post-audit.

Five key principles of capital allocation are as follows:

1. Decisions are based on incremental cash flows. **Sunk costs** (costs that cannot be avoided, even if the project is not undertaken) are not considered. **Externalities** (effects the acceptance of a project may have on other firm cash flows, including **cannibalization** of sales of the firm's current products) should be included in the analysis.
2. Cash flows are based on **opportunity costs,** which are the cash flows the firm will lose by undertaking the project.
3. Timing of the cash flows is important.
4. Cash flows are analyzed on an after-tax basis.

5. Financing costs are reflected in the required rate of return on the project, not in the incremental cash flows.

A project has a **conventional cash flow pattern** if the sign on the cash flows changes only once, with one or more cash outflows followed by one or more cash inflows. An **unconventional cash flow pattern** has more than one sign change.

Projects can be independent and evaluated separately or mutually exclusive, which means the projects compete with each other and the firm can accept only one of them. In some cases, project sequencing requires projects to be undertaken in a certain order, with the accept/reject decision on a second project depending on the outcome of the first project.

A firm with unlimited funds can accept all positive NPV projects. However, when investment capital is limited, the firm must select the group of projects for which the sum of their NPVs is maximized, given the available investment capital.

Net Present Value

Net present value (NPV) for a normal project is the present value of all the expected future cash flows minus the initial cost of the project, using the project's cost of capital. A project that has a positive NPV should be accepted because it is expected to increase the value of the firm (shareholder wealth).

The steps in calculating an NPV are as follows:

- Identify all outflows/inflows associated with the investment.
- Determine the discount rate appropriate for the investment.
- Find PV of the future cash flows. Inflows are positive and outflows are negative.
- Compute the sum of all the discounted future cash flows.
- Subtract the initial cost of the investment or capital project.

$$NPV = \frac{CF_1}{(1+r)} + \frac{CF_2}{(1+r)^2} + \ldots + \frac{CF_t}{(1+r)^t} - NI$$

where:
CF_t = the expected net cash flow at time t
r = the discount rate = opportunity cost of capital
NI = the net (time = 0) investment in the project

With uneven cash flows, use the CF function.

A key advantage of NPV is that it is a direct measure of the expected increase in the value of the firm. Its main weakness is that it does not include any consideration of the size of the project.

In theory, a positive NPV project should cause a proportionate increase in a company's stock price, but reality is more complicated. A company's stock price is a function of the present value of its expected future earnings stream. As a result, changes in the stock price will result more from changes in *expectations* about the profitability of a firm's future investments.

Internal Rate of Return

The **internal rate of return (IRR)** is the discount rate that makes the present value of the expected future cash flows equal to the initial cost of the project—that is, the discount rate that makes the NPV = 0. If the IRR is greater than the project's cost of capital, it should be accepted because it is expected to increase firm value. For this reason, the minimum IRR that a firm requires internally for a project to be accepted is often referred to as the **hurdle rate**.

When given a set of equal cash inflows, such as an annuity, calculate IRR by solving for I / Y.

A key advantage of IRR is that it measures profitability as a percentage, showing the return on each dollar invested. The disadvantages of the IRR method are (1) the possibility of producing rankings of mutually exclusive projects different from those from NPV analysis and (2) the possibility that a project has multiple IRRs or no IRR.

Return on Invested Capital

A company's **return on invested capital (ROIC)**, or simply **return on capital**, is defined as its **net operating profit after tax (NOPAT)**, or simply after-tax net profit over a period, divided by the average book value of its total capital over the period.

$$\text{ROIC} = \frac{\text{after-tax net profit}}{\text{average book value of total capital}}$$

or

$$\text{ROIC} = \frac{\text{NOPAT}}{\text{average book value of total capital}}$$

Because ROIC measures the after-tax return on the amounts invested by both equity investors and debtholders, we can compare it to the company's weighted average cost of capital (WACC). If a firm's ROIC is greater than its WACC, then the company's management is increasing the value of the firm.

Real Options

Real options are future actions that a firm can take, given that they invest in a project today. Real options are similar to financial options in that they give the option holder the right, but not the obligation, to take a future action and, therefore, cannot have negative values. The value of real options should be included in the calculation of the project's NPV.

Types of real options include the following:

- **Timing options** allow a company to delay making an investment because they expect to have better information in the future.
- **Abandonment options** allow a company to abandon a project (similar to put options).
- **Expansion options** allow a company to make additional investments in future projects (similar to call options).
- **Flexibility options** give managers choices regarding the operational aspects of a project. The two main forms are price-setting and production flexibility options.
- **Fundamental options** are projects that are options themselves because the payoffs depend on the price of an underlying asset, such as operating a mine only when prices

are high for the ore.

Capital Allocation Pitfalls

Common mistakes managers make when evaluating capital projects include the following:

- Failing to incorporate economic responses (e.g., by competitors) into the analysis.
- Misusing standardized templates.
- Giving special consideration to pet projects of senior management.
- Basing investment decisions on earnings per share or return on equity.
- Using the IRR criterion for mutually exclusive projects.
- Estimating cash flows poorly.
- Misestimating overhead costs.
- Using the incorrect discount rate.
- Spending the entire capital budget despite a lack of positive NPV projects.
- Failing to generate alternative investment ideas.
- Improperly handling sunk and opportunity costs.

WORKING CAPITAL & LIQUIDITY

Companies choose financing sources based on cost, risk, and flexibility. Sources of capital may be internal or external to a company. Internal sources of funds refer primarily to a company's operating cash flow. A company may also generate short-term funds by collecting accounts receivable sooner, delaying the payment of accounts payable, and selling inventory or marketable securities. External sources of funds include financial intermediaries and capital markets.

Large, financially sound companies may have access to **bank lines of credit**. Lines of credit may be uncommitted (a bank extends an offer of credit for a certain amount but may refuse to lend if circumstances change), committed (a bank extends an offer of credit that it commits to for a specified period for a fee), or revolving (which can be drawn on and repaid as the firm chooses over a longer term—sometimes years).

Companies with weaker credit may have to pledge assets as collateral for bank borrowings. Fixed assets, inventory, and accounts receivable may all serve as collateral for loans. Short-term financing is typically collateralized by receivables or inventory and longer-term loans are secured with a claim to fixed assets. **Secured (asset-backed) loans** are backed by collateral—for example, fixed assets, receivables, or inventory. **Factoring** refers to the sale of receivables to a financial intermediary at a discount to their face value.

Companies can issue **public debt** (trades on public markets) or **private debt** (provided by private entities and not actively traded). Interest rates on a company's debt depend on current market conditions, the company's creditworthiness, and the collateral, if any. Large, creditworthy companies often issue short-term debt securities called commercial paper. Long-term debt often carries a fixed interest rate through maturity, which may be decades after issuance.

Companies sell **common equity** (common stock) both in public markets and privately. Equity owners have a lower priority to a firm's cash flows than debtholders, making a company's equity riskier than its debt. **Preferred stock** (preference shares) has qualities of both debt and equity. Preferred stock typically promises fixed dividend payments and has no maturity date. Other capital market sources of financing include convertible preferred stock, convertible bonds, and leases.

The largest publicly traded companies have access to sources of funding that smaller or privately held companies do not. Companies without stable and substantial operating cash flows will find some types of debt financing expensive or not available at all. Companies with valuable liquid assets will find debt financing more available because such assets can be pledged as collateral.

Companies that have access to and utilize public debt markets tend to match the maturities of their outstanding debt to the lives of their various assets. Companies with significant operations and assets in a country that uses a different currency will often finance them with debt denominated in that currency.

A company's need to carry inventory, its liquidity requirements, its extension of credits to customers, and its use of trade credit all factor into its need for working capital.

To manage working capital, companies may employ a conservative strategy (high current assets as a percentage of sales), an aggressive strategy (low current assets as a percent of sales), or a moderate strategy between the two. A conservative strategy provides greater financial flexibility, while an aggressive strategy should increase returns on assets.

Financing current assets with equity or long-term debt is considered a conservative strategy, while financing current assets with short-term debt is considered aggressive. Some companies finance current assets they view as permanent with equity or long-term debt, while financing seasonal or other variable current assets with short-term debt.

Evaluating a Company's Liquidity

Primary sources of liquidity are a company's normal sources of short-term cash, such as selling goods and services, collecting receivables, or using trade credit and short-term borrowing. **Secondary sources of liquidity** are the measures a company must take to generate cash when its primary sources are inadequate, such as liquidating assets, renegotiating debt, or filing for bankruptcy.

Drags and pulls on liquidity include uncollectable receivables or debts, obsolete inventory, tight short-term credit, and poor payables management.

Liquidity measures include the following:

- Current ratio.
- Quick ratio.
- Cash ratio.
- Receivables turnover (number of days of receivables).
- Inventory turnover (number of days of inventory).
- Payables turnover (number of days of payables).
- Operating cycle or cash conversion cycle.

$$\text{operating cycle} = \text{days of inventory} + \text{days of receivables}$$

$$\text{cash conversion cycle} = \text{days of inventory} + \text{days of receivables} - \text{days of payables}$$

Choices of Short-Term Funding

A company's short-term funding plan should ensure that it maintains sufficient borrowing capacity to meet its ongoing needs, including seasonal or other times of peak requirements. The primary consideration when choosing a strategy for short-term funding is cost.

Companies that rely on significant short-term financing should use more than one type of financing and multiple lenders. Even companies that rely on one particular type of funding may find it advantageous to work with more than one lender. Maintaining excess funding for unforeseen events or to take advantage of business opportunities is also important.

COST OF CAPITAL—FOUNDATIONAL TOPICS

Know how to calculate the after-tax cost of each component of a firm's capital structure and its **weighted average cost of capital (WACC)**.

$$\text{WACC} = (w_d)[k_d(1 - t)] + (w_{ps})(k_{ps}) + (w_{ce})(k_{cd})$$

Here, the *w*s are the proportions of each type of capital, the *k*s are the current costs of each type of capital (debt, preferred stock, and common stock), and *t* is the firm's marginal tax rate.

The proportions used for the three types of capital are target proportions and are calculated using market values. An analyst can use the WACC to compare the after-tax cost of raising capital to the expected after-tax returns on capital investments.

Cost of equity capital has two methods of calculation. You will likely know which to use by the information given in a problem.

1. *CAPM approach*. $k_{ce} = R_f + \beta(R_{market} - R_f)$.
2. *Bond yield plus risk premium approach*. k_{ce} = current market yield on the firm's long-term debt + risk premium.

Cost of preferred stock is a preferred share's annual dividend divided by its market price:

$$k_{ps} = \frac{D_{ps}}{P}$$

Cost of debt is the average market yield on the firm's outstanding debt issues. Since interest is tax deductible, k_d is multiplied by (1 – t). In tax jurisdictions where interest payments are not tax-deductible, *t* is zero and the pre-tax and after-tax cost of debt are the same.

A firm's decisions about which projects to undertake are independent of its decisions about how to finance its assets at minimum cost. Management will have long-run target weights for the percentages of common equity, preferred stock, and debt used to fund the firm. Investment decisions should be based on a WACC that reflects each source of capital at its target weight, regardless of how a particular project will be financed or which capital source was most recently employed.

Beta Estimation and Flotation Costs

Studies have shown that stock betas move toward one over time. To adjust for this reversion toward one, we can estimate an **adjusted beta**:

$$\text{adjusted beta} = \frac{2}{3} \times \text{unadjusted beta} + \frac{1}{3}$$

A **target beta** can be used to determine the appropriate cost of equity capital for a thinly traded or nonpublic company. A target beta is estimated based on the equity beta of a firm purely engaged in the same business as the target company. That firm's beta must be adjusted for any difference between its capital structure (leverage) and the capital structure of the target company.

When new equity is issued, the flotation costs (underwriting costs) should be included as an addition to the initial outlay for the project when calculating NPV or IRR.

CAPITAL STRUCTURE

A company's **capital structure** refers to how it has financed its assets and operations. In general, a company will choose a capital structure with weights of debt and equity that minimize its weighted average cost of capital. When we discuss a company's capital structure, we use market values for both debt and equity, not balance sheet values.

Factors that affect capital structures may be internal or external to a firm. Internal factors include:

- *Characteristics of the business or industry*. Other things being equal, companies in non-cyclical industries, with low fixed operating costs, with subscription-based revenue models, or with a greater proportion of liquid and fungible assets, are better able to support high proportions of debt than companies in cyclical industries, with high fixed costs, with pay-per-use revenue models, or with less liquid collateral assets.
- *Existing debt level*. A higher current ratio and high profitability ratios indicate a greater ability to repay debt. Many analysts consider it a warning sign if a company's debt-to-EBITDA ratio is greater than three, or if its interest coverage ratio is less than two.
- *Corporate tax rate*. Where interest paid is tax deductible, higher tax rates increase the value to a company of the tax shield from interest, and increase the proportion of debt financing.
- *Life cycle stage*. Start-up companies are financed almost exclusively with equity because their earnings and cash flows are low or negative, business risk is relatively high, and balance sheet assets typically are low. For growth stage companies, debt financing is less costly, and debt may be as much as 20% of their capital structure. For mature stage

companies, debt financing is widely available at a relatively low cost, and debt may be significantly more than 20% of their capital structure.

- *Management preferences*. Management may choose a proportion of debt based on bond covenant requirements or on debt rating thresholds. If a company's bond rating drops from investment grade (BBB– or above) to speculative grade (BB+ or below), its cost of debt is likely to increase significantly.

External factors include:

- *Market and business cycle conditions*. Companies prefer to issue debt when market interest rates or credit spreads are cyclically low, as they tend to be during business cycle expansions.
- *Regulation*. Some industries, such as financial institutions and public utilities, are subject to capital adequacy requirements (i.e., minimum proportions of equity).
- *Industry norms*. Factors that affect capital structure tend to be similar for companies in the same industry.

Modigliani-Miller Propositions

In their seminal work on capital structure theory, Franco Modigliani and Merton Miller (we will refer to them as MM) demonstrate that, under certain assumptions, the value of a firm is unaffected by its capital structure. We refer to this as **MM Proposition I with no taxes (MM I)**. The assumptions are as follows:

- Perfectly competitive capital markets with no taxes, transactions costs, or bankruptcy costs.
- Homogeneous expectations with respect to cash flows generated by the firm.
- Riskless borrowing and lending at the risk-free rate.
- No agency costs or conflicts of interest between managers and shareholders.
- Financing decisions do not affect investment decisions or operating income.

MM Proposition II (MM II) is framed in terms of a firm's cost of capital, rather than firm value. Based on the same assumptions as MM I, MM II states that the cost of equity increases linearly as a company increases its proportion of debt financing, so the savings from increasing the amount of (lower-cost) debt financing just offset the increased cost of equity capital. Based on this relationship, MM II concludes that a firm's WACC is unchanged by changes in the proportion of debt financing in its capital structure.

Next, we examine the MM propositions when we relax the assumption of no taxes. Under the tax codes of most countries, interest payments are tax deductible, while dividends paid to equity holders are not. This differential tax treatment encourages firms to use debt financing because debt provides a **tax shield** that adds value to the company (the value of taxes avoided). If a firm were 100% financed with debt, the taxes avoided would be at a maximum so that the after-tax cash flows of the firm would be at a maximum as well. Thus, **MM Proposition I with taxes** concludes that the value of the firm is maximized with 100% debt financing.

In practice, companies do not finance their assets with anything close to 100% debt. Current theory suggests that differences in financial leverage result from costs of using debt financing that we have not yet considered, such as the **costs of financial distress**.

These include direct costs, such as legal and administrative fees associated with bankruptcy, and indirect costs, such as foregone investment opportunities and the costs that result from losing the trust of customers and other stakeholders. Additionally, financial distress imposes **agency costs of debt** by creating conflicts of interest between managers (who represent equity owners) and debtholders. In general, higher amounts of financial leverage increase the probability of financial distress. Higher expected costs of financial distress tend to discourage companies from using large proportions of debt in their capital structures.

Static trade-off theory seeks to balance the costs of financial distress with the tax shield benefits from using debt. It suggests the **optimal capital structure** for a firm—where its WACC is minimized and its value is maximized—is the amount of debt financing at which the increase in the value of the tax shield from additional borrowing is exceeded by the value reduction of higher expected costs of financial distress. Each firm's optimal capital structure depends on its business risk, tax rate, corporate governance, industry influences, and other factors.

Target Capital Structure

To maximize its value, a firm seeks to achieve a target capital structure, on average over time, that reflects management's beliefs about its optimal capital structure. In practice, a firm's actual capital structure tends to fluctuate around the target capital structure because market values of a firm's equity and debt fluctuate, and management may choose to exploit opportunities in a specific financing source.

For analysis, the weights to use when estimating a firm's WACC should be based on its target capital structure, but most firms do not provide one. Alternatives for estimating target capital structure include using a firm's current capital structure based on market values (possibly incorporating any noticeable trends) and using the average capital structure weights for a firm's industry.

Factors Affecting Target Capital Structure

The costs of using less than the optimal amount of debt are relatively small, while the costs of using too much debt may be quite large. A company will base its capital structure decision on its investments and its ability to support debt, given its business risk, the nature of its assets, and its expected operating cash flows.

Market conditions can also influence a firm's financing decisions. Firms may issue equity when they perceive the market price of their stock to be temporarily high, or they may repurchase their stock when management judges it to be too low in the market. When market interest rates fall, or are thought to be temporarily low, firms will likely show a preference for issuing debt. Investors may infer from these financing decisions whether management believes the firm's shares are overvalued or undervalued or management's expectations for future cash flows. For example, taking on the commitment to make fixed interest payments through debt financing sends a signal that management is confident in the firm's ability to make these payments in the future. By contrast, issuing equity is typically viewed as a negative signal that managers believe a firm's stock is overvalued.

Agency costs of equity are related to conflicts of interest between managers and owners. They include **monitoring costs** associated with supervising management, **bonding costs** of

assuring shareholders that managers are working in the shareholders' best interests, and residual losses that may occur even with adequate monitoring and bonding provisions. According to **agency theory**, greater financial leverage tends to reduce agency costs because the use of debt gives managers less free cash flow to use imprudently.

Pecking order theory suggests that managers prefer to make financing choices that are least likely to send negative signals to investors. Financing choices follow a hierarchy based on visibility to investors. Internally generated capital is most preferred, debt is the next-best choice, and external equity is the least preferred financing option.

Competing Stakeholder Interests

A company's various stakeholders may have interests that conflict with those of management in terms of capital structure decisions, especially the issuance of debt. For a company's debtholders, the best possible outcome is that their promised payments are made in full and as scheduled. Their upside is strictly limited with respect to company performance, while their downside is a loss of 100%. For equity owners, while the downside is also a loss of 100% of their investment, their upside could be some multiple of their investment if firm performance is exceptionally good. As a result of this asymmetry, debtholders prefer that a company issues less debt to decrease the probability of financial distress, while common stockholders may prefer greater debt financing even though that increases company risk. The conflict of interest between the owners of common shares and holders of preferred stock is similar to the conflict of interest between common stockholders and debtholders.

The interests of a shareholder who holds voting control may differ not only from the interests of debtholders, but also from the interests of other common stock investors. A controlling shareholder may pursue personal interests that will not necessarily increase shareholder value, may have a short-term focus if they intend to sell their shares, and may oppose share issuance that would dilute their holdings.

Banks and private lenders often have access to nonpublic information about a firm's operations and can more easily restructure debt or adjust terms if problems arise. They often work with management to ensure that their interests are considered in company decisions regarding issuance of additional debt. Private lenders typically hold debt to maturity, while owners of public debt can usually sell that debt if they believe the company's financial health is deteriorating.

Customers of specialized products have an interest in the financial health and survival of firms that are their key suppliers. Similarly, suppliers of custom products for a specific company have a particular interest in that firm's stability. Suppliers in general typically are short-term creditors of a firm and thus have an interest in the firm's continuing ability to meet its obligations.

While employees sometimes own the company's common stock, the value of their employment with the company is usually much larger than their stock ownership. Employees who have specialized skills, such that they would face difficulties in finding alternative employment, have a stronger preference for less financial and operational risk compared with employees who have skills that are more easily transferable.

Senior managers may be compensated with stock options that affect their incentives. Owning stock options magnifies the benefits of increases in share values and can therefore increase management's appetite for risk. On the other hand, because senior managers are often very highly paid, they may prefer that the company take on less risk as they focus primarily on the company's survival and their continued employment.

MEASURES OF LEVERAGE

Business Risk vs. Financial Risk

Business risk refers to the risk associated with a firm's operating income and is the result of:

- Sales risk (variability of demand).
- Operating risk (proportion of total costs that are fixed costs).

Financial risk. Additional risk common stockholders have to bear because the firm uses fixed cost sources of financing.

Degree of operating leverage (DOL) is defined as:

$$\text{DOL} = -\frac{\%\text{ change in EBIT}}{\%\text{ change in sales}}$$

The DOL at a particular level of sales, Q, is calculated as:

$$\text{DOL} = \frac{Q(P-V)}{Q(P-V)-F}$$

$$= \frac{S-TVC}{S-TVC-F}$$

One way to help remember this formula is to know that if fixed costs are zero, there is no operating leverage (i.e., DOL = 1).

Degree of financial leverage (DFL) is defined as:

$$\text{DFL} = \frac{\%\text{ change in EPS}}{\%\text{ change in EBIT}}$$

The DFL at a particular level of sales is calculated as:

$$\text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - \text{interest expense}}$$

One way to help remember this formula is to know that if interest costs are zero (no fixed-cost financing), there is no financial leverage (i.e., DFL = 1). In this context, we treat preferred dividends as interest.

Degree of total leverage (DTL) is the product of DOL and DFL:

$$\begin{aligned}\text{DTL} &= \text{DOL} \times \text{DFL} \\ &= \frac{\%\text{ change in EBIT}}{\%\text{ change in sales}} \times \frac{\%\text{ change in EPS}}{\%\text{ change in EBIT}} = \frac{\%\text{ change in EPS}}{\%\text{ change in sales}} \\ &= \frac{Q(P-V)}{Q(P-V)-F-I} = \frac{S-TVC}{S-TVC-F-I}\end{aligned}$$

Breakeven Quantity of Sales

A firm's *breakeven point* is the quantity of sales a firm must achieve to just cover its fixed and variable costs. The breakeven quantity is calculated as:

$$Q_{BE} = \frac{\text{total fixed costs}}{\text{price} - \text{variable cost per unit}}$$

The *operating breakeven quantity* considers only fixed operating costs:

$$Q_{OBE} = \frac{\text{fixed operating costs}}{\text{price} - \text{variable cost per unit}}$$

Effects of Operating Leverage and Financial Leverage

A firm with greater operating leverage (greater fixed costs) will have a higher breakeven quantity than an identical firm with less operating leverage. If sales are greater than the breakeven quantity, the firm with greater operating leverage will generate larger profit.

Financial leverage reduces net income by the interest cost, but increases return on equity because the (reduced) net income is generated with less equity (and more debt). A firm with greater financial leverage will have a greater risk of default, but will also offer greater potential returns for its stockholders.

EQUITY INVESTMENTS

Weight on Exam	10% to 12%
SchweserNotes™ Reference	Book 3, Pages 105–236

MARKET ORGANIZATION AND STRUCTURE

The three main functions of the financial system are to:

1. Allow entities to save and borrow money, raise equity capital, manage risks, trade assets currently or in the future, and trade based on their estimates of asset values.
2. Determine the returns (i.e., interest rates) that equate the total supply of savings with the total demand for borrowing.
3. Allocate capital to its most efficient uses.

Assets and Markets

Financial assets include securities (stocks and bonds), derivative contracts, and currencies. **Real assets** include real estate, equipment, commodities, and other physical assets.

Debt securities are promises to repay borrowed funds. **Equity securities** represent ownership positions.

Public securities are traded on exchanges or through securities dealers and are subject to regulatory oversight. Securities that are not traded in public markets are referred to as **private securities**. Private securities are often illiquid and not subject to regulation.

Derivative contracts have values that are derived from the values of other assets. **Financial derivative contracts** are based on equities, equity indexes, debt, debt indexes, or other financial contracts. **Physical derivative contracts** derive their values from the values of physical assets such as gold, oil, and wheat.

Markets for immediate delivery are referred to as **spot markets**. Contracts for the future delivery of physical and financial assets include forwards, futures, and options.

The **primary market** is the market for newly issued securities. Subsequent sales of securities are said to occur in the **secondary market**.

Money markets refer to markets for debt securities with maturities of one year or less. **Capital markets** refer to markets for longer-term debt securities and equity securities that have no specific maturity date.

Traditional investment markets refer to those for debt and equity. **Alternative markets** refer to those for hedge funds, commodities, real estate, collectibles, gemstones, leases, and equipment. Alternative assets often are more difficult to value, illiquid, and require investor due diligence.

Types of Securities

Fixed income securities typically refer to debt securities that are promises to repay borrowed money in the future.

Convertible debt is debt that an investor can exchange for a specified number of equity shares of the issuing firm.

Equity securities represent ownership in a firm and include common stock, preferred stock, and warrants.

- **Common stock** is a residual claim on a firm's assets.
- **Preferred stock** is an equity security with scheduled dividends that typically do not change over the security's life and must be paid before any dividends on common stock may be paid.
- **Warrants** are similar to options in that they give the holder the right to buy a firm's equity shares at a fixed exercise price prior to the warrant's expiration.

Pooled investment vehicles include mutual funds, depositories, and hedge funds. The investor's ownership interests are referred to as *shares, units*, *depository receipts*, or *limited partnership interests*.

- **Mutual funds** are pooled investment vehicles in which investors can purchase shares, either from the fund itself (open-end funds) or in the secondary market (closed-end funds).
- **Exchange-traded funds (ETFs)** and **exchange-traded notes (ETNs)** trade like closed-end funds, but have special provisions for in-kind creation and redemption.
- **Asset-backed securities** represent a claim to a portion of the cash flows from a pool of financial assets such as mortgages, car loans, or credit card debt.
- **Hedge funds** are organized as limited partnerships, and purchase is usually restricted to investors of substantial wealth and investment knowledge.

Contracts

Financial contracts are often based on securities, currencies, commodities, or security indexes (portfolios). They include futures, forwards, options, swaps, and insurance contracts.

Forward contracts are agreements to buy or sell an asset in the future at a price specified in the contract at its inception and are not typically traded on exchanges or in dealer markets.

Futures contracts are similar to forward contracts except that they are standardized as to amount, asset characteristics, and delivery time, and are traded on an exchange.

In a **swap contract**, two parties make payments that are equivalent to one asset or portfolio being traded for another. In a simple *interest rate swap*, floating rate interest payments are exchanged for fixed-rate payments over multiple settlement dates. A *currency swap* involves a loan in one currency for the loan of another currency for a period of time. An *equity swap* involves the exchange of the return on an equity index or portfolio for the interest payment on a debt instrument.

A **call option** gives the option buyer the right (but not the obligation) to buy an asset. A **put option** gives the option buyer the right (but not the obligation) to sell an asset.

An **insurance contract** pays a cash amount if a future event occurs.

Credit default swaps are a form of insurance that makes a payment if an issuer defaults on its bonds.

Currencies, Commodities, and Real Assets

Currencies are issued by a government's central bank. Some are referred to as **reserve currencies**, which are those held by governments and central banks worldwide and include the dollar and euro, and secondarily the British pound, Japanese yen, and Swiss franc.

Commodities trade in spot, forward, and futures markets. They include precious metals, industrial metals, agricultural products, energy products, and credits for carbon reduction.

Examples of **real assets** are real estate, equipment, and machinery. Although they have been traditionally held by firms for their use in production, real assets are increasingly held by institutional investors both directly and indirectly.

Brokers, Dealers, and Exchanges

Brokers help their clients buy and sell securities by finding counterparties to trades in a cost efficient manner.

Block brokers help with the placement of large trades.

Investment banks help corporations sell common stock, preferred stock, and debt securities to investors. They also provide advice to firms, notably about mergers, acquisitions, and raising capital.

Exchanges provide a venue where traders can meet. Exchanges sometimes act as brokers by providing electronic order matching.

Alternative trading systems (ATS), which serve the same trading function as exchanges but have no regulatory function, are also known as **electronic communication networks** or **multilateral trading facilities**. ATS that do not reveal current client orders are known as *dark pools*.

Dealers facilitate trading by buying for or selling from their own inventory.

Some dealers also act as brokers. **Broker-dealers** have an inherent conflict of interest. As brokers, they should seek the best prices for their clients, but as dealers, their goal is to profit through prices or spreads. As a result, traders typically place limits on how their orders are filled when they transact with broker-dealers.

Dealers that trade with central banks when the banks buy or sell government securities in order to affect the money supply are referred to as **primary dealers**.

Investment Positions

An investor who owns an asset, or has the right or obligation under a contract to purchase an asset, is said to have a **long position**. A **short position** can result from borrowing an asset and selling it, with the obligation to replace the asset in the future (a short sale). The

party to a contract who must sell or deliver an asset in the future is also said to have a short position. In general, investors who are long benefit from an increase in the price of an asset and those who are short benefit when the asset price declines.

In a **short sale**, the short seller (1) simultaneously borrows and sells securities through a broker, (2) must return the securities at the request of the lender or when the short sale is closed out, and (3) must keep a portion of the proceeds of the short sale on deposit with the broker. Short sellers hope to profit from a fall in the price of the security or asset sold short. The repayment of the borrowed security or other asset is referred to as "covering the short position."

Margin Transactions

Margin purchase transactions involve paying for part of the cost of a security, a loan for the rest from a broker, and leaving the securities on deposit with the broker as collateral. Currently a maximum of 50% of the purchase price can be borrowed. A minimum of 50% of the purchase price must be deposited in cash which is referred to as the *initial margin*.

The *equity* in a margin account for a long position is the market value of the securities minus the loan amount. At any point in time, the *margin percentage* in an account is the equity in the account as a percentage of the market value of the securities held. *Maintenance margin*, or minimum margin, is the minimum percentage of equity permitted; if the margin percentage falls below this minimum, more cash or securities must be deposited in order to maintain the position.

To calculate the rate of return on a margin transaction, divide the gain or loss on the security position by the margin deposit.

The following formula indicates how to calculate the stock price that will trigger a margin call based on the initial price, P_0 (for a long position).

$$\text{trigger price (margin purchases)} = P_0\left(\frac{1 - \text{initial margin\%}}{1 - \text{maintenance margin\%}}\right)$$

Bid and Ask Prices

Securities dealers provide prices at which they will buy and sell shares. The **bid price** is the price at which a dealer will buy a security. The **ask** or **offer price** is the price at which a dealer will sell a security. The difference between the bid and ask prices is referred to as the **bid-ask spread** and is the source of a dealer's compensation. The bid and ask are quoted for specific trade sizes (**bid size** and **ask size**).

The quotation in the market is the highest dealer bid and lowest dealer ask from among all dealers in a particular security. More liquid securities have market quotations with bid-ask spreads that are lower (as a percentage of share price) and therefore have lower transactions costs for investors. Traders who post bids and offers are said to *make a market*, while those who trade with them at posted prices are said to *take the market*.

Execution Instructions

The most common orders, in terms of execution instructions, are market or limit orders. A **market order** instructs the broker to execute the trade immediately at the best available price. A **limit order** places a *minimum* execution price on sell orders and a *maximum* execution price on buy orders. The disadvantage of a limit order is that it might not be filled.

Validity Instructions

Validity instructions specify *when* an order should be executed. Most orders are **day orders**, meaning they expire if unfilled by the end of the trading day. Good-till-cancelled orders remain open until they are filled. **Immediate or cancel** orders (also known as **fill or kill** orders) are cancelled unless they can be filled immediately. **Good-on-close** orders are only filled at the end of the trading day. If they are market orders, they are referred to as **market-on-close** orders. These are often used by mutual funds because their portfolios are valued using closing prices. There are also **good-on-open** orders.

Stop (stop loss) orders are not executed unless the stop price has been reached. A **stop sell order** is placed at a "stop" price below the current market price, executes if the stock trades at or below the stop price, and can limit the losses on a long position. A **stop buy order** is placed at a "stop" price above the current market price, executes if the stock trades at or above the stop price, and can limit losses on a short position.

Primary and Secondary Markets

Primary capital markets refers to the markets for newly issued securities, either:

- Initial public offerings (IPOs).
- **Seasoned offerings** (secondary issues).

Secondary financial markets refers to markets where previously issued securities trade.

Market Structures

In **call markets**, orders are accumulated and securities trade only at specific times. Call markets are potentially very liquid when in session because all traders are present, but they are obviously illiquid between sessions. In a call market, all trades, bids, and asks are at prices that are set to equate supply and demand.

In **continuous markets**, trades occur at any time the market is open with prices set either by the auction process or by dealer bid-ask quotes.

There are three main categories of securities markets: *quote-driven markets* where investors trade with dealers, *order-driven markets* where rules are used to match buyers and sellers, and *brokered markets* where investors use brokers to locate a counterparty to a trade.

In **quote-driven markets**, traders transact with dealers (market makers) who post bid and ask prices. Dealers maintain an inventory of securities. Quote-driven markets are thus sometimes called **dealer markets**, **price-driven markets**, or **over-the-counter markets**. Most securities other than stocks trade in quote-driven markets. Trading often takes place electronically.

In **order-driven markets**, orders are executed using trading rules, which are necessary because traders are usually anonymous. Exchanges and automated trading systems are examples of order-driven markets.

In **brokered markets**, brokers find the counterparty in order to execute a trade. This service is especially valuable when the trader has a security that is unique or illiquid. Examples are large blocks of stock, real estate, and artwork. Dealers typically do not carry an inventory of these assets and there are too few trades for these assets to trade in order-driven markets.

Characteristics of a Well-Functioning Financial System

A market is said to be **complete** if:

- Investors can save for the future at fair rates of return.
- Creditworthy borrowers can obtain funds.
- Hedgers can manage their risks.
- Traders can obtain the currencies, commodities, and other assets they need.

If a market can perform these functions at low trading costs (including commissions, bid-ask spreads, and price impacts) it is said to be **operationally efficient**. If security prices reflect all public information associated with fundamental value in a timely fashion, then the financial system is **informationally efficient**. A well-functioning financial system has complete markets that are operationally and informationally efficient, with prices that reflect fundamental values. Furthermore, in informationally efficiently markets, capital is allocated to its most productive uses. That is, markets are also **allocationally efficient**.

SECURITY MARKET INDEXES

A **security market index** is used to represent the performance of an asset class, security market, or segment of a market. Individual securities are referred to as the **constituent securities** of an index.

A price index is based on security prices, and the percentage change in a price index is referred to as its **price return**. The price return on an index plus the return from dividends paid on index stocks is referred to as the **total return** of an index.

Index Weighting Methods

A **price-weighted index** is the arithmetic average of the prices of its constituent securities. The divisor of a price-weighted index must be adjusted for stock splits and for changes in the composition of the index so that the index value is unaffected by such changes.

$$\text{price-weighted index} = \frac{\text{sum of stock prices}}{\text{number of stocks in index}}$$

A given percentage price change on a high-priced stock will have a greater impact on index returns than it will on a low-priced stock. Weights based on prices are considered somewhat arbitrary, and the weights of all index stocks must be adjusted when an index

stock splits. A portfolio with equal numbers of shares of each index stock will match the performance of a price-weighted index.

An **equal-weighted index** is calculated as the arithmetic average of the returns of index stocks and would be matched by the returns on a portfolio that had equal dollar amounts invested in each index stock. When stock prices change, however, portfolio weights change and the portfolio must be rebalanced periodically to restore equal weights to each index security. Compared to a price-weighted index, an equal-weighted index places more (less) weight on the returns of low-priced (high-priced) stocks. Compared to a market capitalization-weighted index, an equal-weighted index places more (less) weight on returns of stocks with small (large) market capitalizations.

In a **market capitalization-weighted index** (or **value-weighted index**), returns are weights based on the market capitalization of each index stock (current stock price times the number of shares outstanding) as a proportion of the total market capitalization of all the stocks in the index. A market capitalization-weighted index does not need to be adjusted when a stock splits or pays a stock dividend.

$$\text{current index value} = \frac{\text{current total market value of index stocks}}{\text{base year total market value of index stocks}} \times \text{base year index value}$$

A **float-adjusted market capitalization-weighted index** is constructed like a market capitalization-weighted index. The weights, however, are based on the proportionate value of each firm's shares that are available to investors to the total market value of the shares of index stocks that are available to investors. Firms with relatively large percentages of their shares held by controlling stockholders will have less weight than they have in an unadjusted market-capitalization index.

The advantage of market capitalization-weighted indexes of either type is that index security weights represent proportions of total market value.

An index that uses **fundamental weighting** uses weights based on firm fundamentals, such as earnings, dividends, or cash flow. An advantage of a fundamental-weighted index is that it avoids the bias of market capitalization-weighted indexes toward the performance of the shares of overvalued firms and away from the performance of the shares of undervalued firms.

Rebalancing and Reconstitution

Rebalancing refers to periodically adjusting the weights of securities in an index or portfolio to their target weights, and it is important for equal-weighted indexes as portfolio weights change as prices change.

Index **reconstitution** occurs when the securities that make up an index are changed. Securities are deleted if they no longer meet the index criteria and are replaced by securities that do.

Index Types

Equity indexes can be classified as follows:

- *Broad market index*. Provides a measure of a market's overall performance and usually contains more than 90% of the market's total value.
- *Multi-market index*. Typically constructed from the indexes of markets in several countries and is used to measure the equity returns of a geographic region, markets based on their stage of economic development, or the entire world.
- *Multi-market index with fundamental weighting*. Uses market capitalization-weighting for the country indexes, but then weights the country index returns in the global index by a fundamental factor (e.g., GDP).
- *Sector index*. Measures the returns for an industry sector such as health care, financial, or consumer goods firms.
- *Style index*. Measures the returns to market capitalization and value or growth strategies. Some indexes reflect a combination of the two (e.g., small-cap value fund).

Many different **fixed income indexes** are available to investors. The fixed income security universe is much broader than the universe of stocks. Also, unlike stocks, bonds mature and must be replaced in fixed income indexes. As a result, turnover is high in fixed income indexes.

Because fixed income securities often trade infrequently, index providers must often estimate the value of index securities from recent prices of securities with similar characteristics.

Illiquidity, transactions costs, and high turnover of constituent securities make it both difficult and expensive for fixed income portfolio managers to replicate a fixed income index.

Commodity indexes are based on futures contract prices for commodities such as grains, livestock, metals, and energy. Different indexes have significantly different commodity exposures and risk and return characteristics.

Real estate indexes can be constructed using returns based on appraised values, repeat property sales, or the performance of Real Estate Investment Trusts (REITs).

Most **hedge fund indexes** equally weight the returns of the hedge funds included in the index.

Hedge funds are largely unregulated and are not required to report their performance to index providers. It is often the case that those funds that report are the funds that have been successful, as the poorly performing funds do not choose to report their performance. This results in an upward bias in index returns, with hedge funds appearing to be better investments than they actually are.

MARKET EFFICIENCY

An **informationally efficient capital market** is one in which the current price of a security fully and quickly reflects all available information about that security without bias.

In a perfectly efficient market, investors should use a passive investment strategy (i.e., buying a broad market index of stocks and holding it) because active investment strategies

will underperform on average by the amount of transactions costs and management fees. However, to the extent that market prices are inefficient, active investment strategies can generate positive risk-adjusted returns.

Market efficiency increases with:

- Larger numbers of market participants.
- More information available to investors.
- Fewer impediments to trading such as restrictions on short sales.
- Lower transactions costs.

Forms of the Efficient Markets Hypothesis

1. The *weak form* of the hypothesis states that current stock prices fully reflect all price and trading volume (market) information. If weak-form efficiency holds, purely technical analysis has no value.
2. The *semistrong form* of the hypothesis holds that public information cannot be used to beat the market. If stock prices are semistrong-form efficient, neither technical nor fundamental analysis has any value in stock selection.
3. *Strong-form* efficiency states that stock prices fully reflect all information, both public and private. If markets were strong-form efficient, even private (inside) information would be of no value in selecting securities.

Identified Market Pricing Anomalies

A **market anomaly** is something that would lead us to reject the hypothesis of market efficiency.

- The **January effect** or **turn-of-the-year effect** is the finding that during the first five days of January, stock returns, especially for small firms, are significantly higher than they are the rest of the year.
- The **overreaction effect** refers to the finding that firms with poor stock returns over the previous three or five years (losers) have better subsequent returns than firms that had high stock returns over the prior period.
- **Momentum effects** have also been found where high short-term returns are followed by continued high returns.
- The **size effect** refers to evidence that small-cap stocks outperform large-cap stocks. This effect could not be confirmed in later studies, suggesting that either investors had traded on, and thereby eliminated, this anomaly or that the initial finding was simply a random result for the time period examined.
- The **value effect** refers to the finding that value stocks have outperformed growth stocks. Some researchers attribute the value effect to greater risk of value stocks that is not captured in the risk adjustment procedure used in the studies.

The majority of the evidence suggests that reported anomalies are not violations of market efficiency but are due to the methodologies used in the tests of market efficiency. Furthermore, both underreaction and overreaction have been found in the markets, meaning that prices are efficient on average. Other explanations for the evidence of

anomalies are that they are transient relations, too small to profit from, or simply reflect returns to risk that the researchers have failed to account for.

Portfolio management based on previously identified anomalies will likely be unprofitable. Investment management based solely on anomalies has no sound economic basis.

Behavioral Finance

Behavioral finance examines investor behavior, its effect on financial markets, how cognitive biases may result in anomalies, and whether investors are rational.

- **Loss aversion** refers to the tendency for investors to dislike losses more than they like gains of equal amounts.
- **Investor overconfidence.** Securities will be mispriced if investors overestimate their ability to value securities. However, it appears that this mispricing may be hard to predict, may only be temporary, may not be exploitable for abnormal profits, and may only exist for high-growth firms.
- **Representativeness.** Investors assume good companies or good markets are good investments.
- **Mental accounting.** Investors classify different investments into separate mental accounts instead of viewing them as a total portfolio.
- **Conservatism.** Investors react slowly to changes.
- **Narrow framing.** Investors view events in isolation.

Although investor biases may help explain the existence of security mispricing and anomalies, it is not clear that they are predictable enough so that abnormal profits could be earned by exploiting them.

OVERVIEW OF EQUITY SECURITIES

Types of Equity Securities

- **Common shares** represent a residual claim (after the claims of debt holders and preferred stockholders) on firm assets.
- **Preference shares** (or **preferred stock**) have features of both common stock and debt. As with common stock, preferred stock dividends are not a contractual obligation and the shares do not mature. Like debt, preferred shares typically make fixed periodic payments to investors and do not usually have voting rights. Preference shares may be callable, giving the firm the right to repurchase the shares at a specified price. They may also be putable, giving the shareholder the right to sell the preference shares back to the issuer at a specified price.
- **Cumulative preference shares** require that current period dividends and any dividends that were not paid must be made up before common shareholders can receive dividends. The dividends of **non-cumulative preference shares** do not accumulate over time when they are not paid, but dividends for the current period must be paid before common shareholders can receive dividends.
- Investors in **participating preference shares** receive extra dividends if firm profits exceed a predetermined level and may receive a value greater than the par value of the

preferred stock if the firm is liquidated. **Non-participating preference shares** have a claim equal to par value in the event of liquidation and do not share in firm profits.

- **Convertible preference shares** can be exchanged for common stock at a conversion ratio determined when the shares are originally issued.

Private Equity

Private equity is usually issued to institutional investors via private placements. Private equity markets are smaller than public markets but are growing rapidly.

Compared to public equity, private equity has the following characteristics:

- Less liquidity because no public market for the shares exists.
- Share price is negotiated between the firm and its investors, not determined in a market.
- More limited firm financial disclosure because there is no government or exchange requirement to do so.
- Lower reporting costs because of less onerous reporting requirements.
- Potentially weaker corporate governance because of reduced reporting requirements and less public scrutiny.
- Greater ability to focus on long-term prospects because there is no public pressure for short-term results.
- Potentially greater return for investors once the firm goes public.

The three main types of private equity investments are venture capital, leveraged buyouts, and private investments in public equity.

Voting Rights

In a **statutory voting** system, each share held is assigned one vote in the election of each member of the board of directors. Under **cumulative voting**, shareholders can allocate their votes to one or more candidates as they choose.

A firm may have different classes of common stock (e.g., “Class A” and “Class B” shares). One class may have greater voting power and seniority if the firm’s assets are liquidated. The classes may also be treated differently with respect to dividends, stock splits, and other transactions with shareholders.

Foreign Equity

Direct investing in the securities of foreign companies simply refers to buying a foreign firm’s securities in foreign markets. Some obstacles to direct foreign investment are that:

- The investment and return are denominated in a foreign currency.
- The foreign stock exchange may be illiquid.
- The reporting requirements of foreign stock exchanges may be less strict, impeding analysis.
- Investors must be familiar with the regulations and procedures of each market in which they invest.

Methods for Investing in Foreign Companies

Depository receipts (DRs) trade like domestic shares but represent an interest in shares of a foreign firm that are held by a bank in the country in which they trade. When the foreign firm is involved with the issue, they are termed **sponsored DRs**, and investors receive the voting rights for the shares their DRs represent. When the foreign firm is not involved, they are termed **unsponsored DRs**, face less strict reporting requirements, and the depository bank retains the voting rights on the shares.

Global depository receipts (GDRs) are issued outside the U.S. and the issuer's home country, are traded primarily on the London and Luxembourg exchanges, are usually denominated in U.S. dollars, and can be sold to U.S. institutional investors.

American depository receipts (ADRs) are denominated in U.S. dollars and trade in the United States.

Global registered shares (GRS) are traded in different currencies on stock exchanges around the world.

A **basket of listed depository receipts (BLDR)** is an exchange-traded fund (ETF) that is a collection of DRs. ETF shares trade in markets just like common stocks.

Equity Risk and Return Characteristics

The risk of equity securities is most commonly measured as the standard deviation of returns. Preferred shares are less risky than common stock because preferred shares pay a known, fixed dividend. Because they are less risky, preferred shares have lower average returns than common shares.

Cumulative preferred shares have less risk than non-cumulative preferred shares.

For both common and preferred shares, putable shares are less risky and callable shares are more risky compared to shares with neither option.

Callable shares are the most risky because if the market price rises, the firm can call the shares, limiting the upside potential of the shares.

Market and Book Value of Equity

A firm's **book value of equity** is the value of the firm's assets on the balance sheet minus its liabilities.

The **market value of equity** is the total value of a firm's outstanding equity shares based on market prices and reflects the expectations of investors about the firm's future performance.

A key ratio used to determine management efficiency is the **accounting return on equity**, usually referred to simply as the **return on equity (ROE)**:

$$\text{ROE}_t = \frac{\text{NI}_t}{\text{average BV}_t} = \frac{\text{NI}_t}{(\text{BV}_t + \text{BV}_{t-1})/2}$$

A firm's **cost of equity** is the expected equilibrium total return (including dividends) on its shares in the market.

INTRODUCTION TO INDUSTRY AND COMPANY ANALYSIS

Industry analysis is important for company analysis because it provides a framework for understanding the firm. Understanding a firm's business environment can provide insight about the firm's potential growth, competition, and risks. For a credit analyst, industry conditions can provide important information about whether a firm will be able to meet its obligations during the next recession.

Industry Classification Systems

One way to group companies into an industry group is by the *products and services* they offer. For example, the firms that produce automobiles constitute the auto industry. A **sector** is a group of similar industries. Systems that group firms by products and services usually use a firm's **principal business activity** (the largest source of sales or earnings) to classify firms.

Sectors representative of those used by commercial providers include the following:

- Basic materials and processing.
- Consumer discretionary.
- Consumer staples.
- Energy.
- Financial services.
- Health care.
- Industrial and producer durables.
- Real estate.
- Technology.
- Telecommunications and utilities.

Several government bodies provide industry classification of firms.

- *International Standard Industrial Classification of All Economic Activities* (ISIC) was produced by the United Nations in 1948 to increase global comparability of data.
- *Statistical Classification of Economic Activities in the European Community* is similar to the ISIC, but is designed for Europe.
- *Australian and New Zealand Standard Industrial Classification* was jointly developed by those countries.
- *North American Industry Classification System* (NAICS) was jointly developed by the U.S., Canada, and Mexico.

Other Classification Methods

Firms can be classified by their *sensitivity to business cycles*. This system has two main classifications: cyclical and non-cyclical firms.

A **cyclical firm** is one whose earnings are highly dependent on the stage of the business cycle.

A **non-cyclical firm** produces goods and services for which demand is relatively stable over the business cycle. Examples of non-cyclical industries include health care, utilities, and food and beverage.

Cyclical sector examples include energy, financials, technology, materials, and consumer discretionary. Cyclical industries often include growth firms that are less dependent on the business cycle. The term **growth cyclical** is used to describe firms with high expected growth rates that are still sensitive to economic cycles.

Non-cyclical sector examples include health care, utilities, and consumer staples. Non-cyclical industries can be further separated into defensive (stable) or growth industries. **Defensive industries** are those that are least affected by the stage of the business cycle and include utilities, consumer staples (such as food producers), and basic services (such as drug stores). **Growth industries** have demand so strong they are largely unaffected by the stage of the business cycle.

Statistical methods, such as cluster analysis, can also be used. This method groups firms that historically have had highly correlated returns.

This method has several limitations:

- Historical correlations may not be the same as future correlations.
- The groupings of firms may differ over time and across countries.
- The grouping of firms is sometimes non-intuitive.
- The method is susceptible to a central issue in statistics, i.e., firms can be grouped by a relationship that occurs by chance or not grouped together when they should be.

Peer Groups

A **peer group** is a set of companies with similar business activities, demand drivers, cost structure drivers, and availability of capital.

To form a peer group, an analyst will often start by identifying companies in the same industry classification, using the commercial classification providers previously described. Usually, the analyst will use other information to verify that the firms in an industry are indeed peers. An analyst might include a company in more than one peer group.

Elements of an Industry Analysis

A thorough industry analysis should include the following elements:

- Evaluate the relationships between macroeconomic variables and industry trends using information from industry groups, firms in the industry, competitors, suppliers, and customers.
- Estimate industry variables using different approaches and scenarios.

- Compare with other analysts' forecasts of industry variables to confirm the validity of the analysis, and potentially find industries that are misvalued as a result of consensus forecasts.
- Determine the relative valuation of different industries.
- Compare the valuations of industries across time to determine the volatility of their performance over the long run and during different phases of the business cycle. This is useful for long-term investing as well as short-term industry rotation based on the current economic environment.
- Analyze industry prospects based on **strategic groups**, which are groups of firms that are distinct from the rest of the industry due to the delivery or complexity of their products or barriers to entry. For example, full-service hotels are a distinct market segment within the hotel industry.
- Classify industries by **life-cycle stage**, whether it is embryonic, growth, shakeout, mature, or declining.
- Position the industry on the **experience curve**, which shows the cost per unit relative to output. The curve declines because of increases in productivity and economies of scale, especially in industries with high fixed costs.
- Consider the forces that affect industries, which include demographic, macroeconomic, governmental, social, and technological influences.
- Examine the forces that determine competition within an industry.

External Influences on Industries

The external influences on industry growth, profitability, and risk should be a component of an analyst's strategic analysis. These external factors include macroeconomic, technological, demographic, governmental, and social influences.

Macroeconomic factors can be cyclical or structural (longer-term) trends, most notably economic output as measured by GDP or some other measure. Interest rates affect financing costs for firms and individuals, as well as financial institution profitability. Credit availability affects consumer and business expenditures and funding. Inflation affects costs, prices, interest rates, and business and consumer confidence.

Technology can change an industry dramatically through the introduction of new or improved products. Computer hardware is an example of an industry that has undergone dramatic transformation. Radical improvements in circuitry were assisted by transformations in other industries, including the computer software and telecommunications industries. Another example of an industry that has been changed by technology is photography, which has largely moved from film to digital media.

Demographic factors include age distribution and population size, as well as other changes in the composition of the population. As a large segment of the population reaches their twenties, residential construction, furniture, and related industries see increased demand. An aging of the overall population can mean significant growth for the health care industry and developers of retirement communities.

Governments have an important effect on businesses through taxes and regulation. Entry into the health care industry, for example, is controlled by governments that license

providers. Some industries, such as the U.S. defense industry, depend heavily on government purchases of goods and services.

Social influences relate to how people work, play, spend their money, and conduct their lives; these factors can have a large impact on industries. For example, when women entered the U.S. workforce, the restaurant industry benefitted because there was less cooking at home. Child care, women's clothing, and other industries were also dramatically affected.

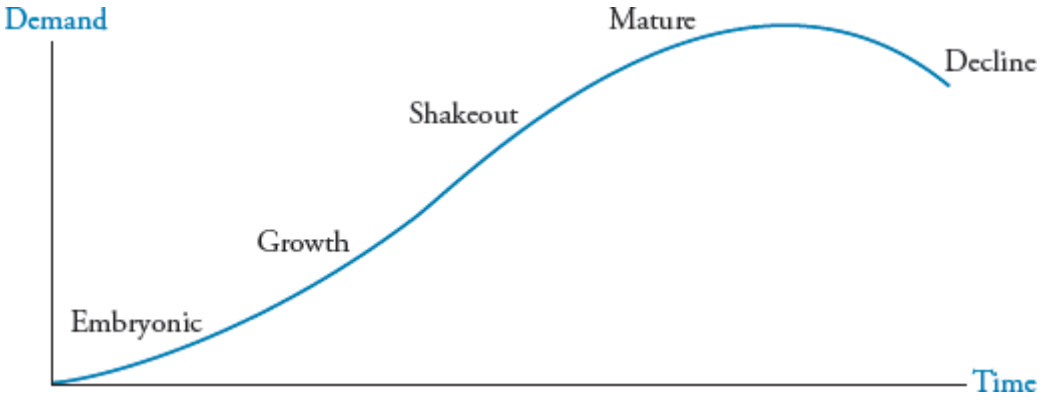
Environmental influences continue to grow in importance as factors in industry growth and profitability. Three primary considerations are as follows:

1. Consumer perceptions about the practices of industries and specific companies can have a significant impact on growth and profitability.
2. Increased government regulation of some industries will change how they operate and affect their cost structures and demand.
3. Changing weather patterns and shortages of water and energy may affect various industries—in particular, agriculture and utilities.

Industry Life Cycle

Industry life cycle analysis should be a component of an analyst's strategic analysis. The five phases of the industry life-cycle model are illustrated in Figure 1.

Figure 1: Stages of the Industry Life Cycle



In the **embryonic stage**, the industry has just started. The characteristics of this stage are as follows:

- *Slow growth*: customers are unfamiliar with the product.
- *High prices*: the volume necessary for economies of scale has not been reached.
- *Large investment required*: to develop the product.
- *High risk of failure*: most embryonic firms fail.

In the **growth stage**, industry growth is rapid. The characteristics of this stage are as follows:

- *Rapid growth*: new consumers discover the product.
- *Limited competitive pressures*: The threat of new firms coming into the market peaks during the growth phase, but rapid growth allows firms to grow without competing on

price.

- *Falling prices*: economies of scale are reached and distribution channels increase.
- *Increasing profitability*: due to economies of scale.

In the **shakeout stage**, industry growth and profitability are slowing due to strong competition. The characteristics of this stage are as follows:

- *Growth has slowed*: demand reaches saturation level with few new customers to be found.
- *Intense competition*: industry growth has slowed, so firm growth must come at the expense of competitors.
- *Increasing industry overcapacity*: firm investment exceeds increases in demand.
- *Declining profitability*: due to overcapacity.
- *Increased cost cutting*: firms restructure to survive and attempt to build brand loyalty.
- *Increased failures*: weaker firms liquidate or are acquired.

In the **mature stage**, there is little industry growth and firms begin to consolidate. The characteristics of this stage are as follows:

- *Slow growth*: market is saturated and demand is only for replacement.
- *Consolidation*: market evolves to an oligopoly.
- *High barriers to entry*: surviving firms have brand loyalty and low cost structures.
- *Stable pricing*: firms try to avoid price wars, although periodic price wars may occur during recessions.
- *Superior firms gain market share*: the firms with better products may grow faster than the industry average.

In the **decline stage**, industry growth is negative. The characteristics of this stage are as follows:

- *Negative growth*: due to development of substitute products, societal changes, or global competition.
- *Declining prices*: competition is intense and there are price wars due to overcapacity.
- *Consolidation*: failing firms exit or merge.

Industry Concentration

High industry concentration does not guarantee pricing power.

- Absolute market share may not matter as much as a firm's market share relative to its competitors.
- If industry products are undifferentiated and commodity-like, then consumers will switch to the lowest-priced producer. Firms in industries with greater product differentiation in regard to features, reliability, and service after the sale will have greater pricing power.
- If an industry is capital intensive, and therefore costly to enter or exit, overcapacity can result in intense price competition.

Tobacco, alcohol, and confections are examples of highly concentrated industries in which firms' pricing power is relatively strong. Automobiles, aircraft, and oil refining are examples

of highly concentrated industries with relatively weak pricing power.

Although industry concentration does not guarantee pricing power, a fragmented market usually does result in strong price competition.

Ease of Entry

High barriers to entry benefit existing industry firms because they prevent new competitors from competing for market share. In industries with low barriers to entry, firms have little pricing power. To assess the ease of entry, the analyst should determine how easily a new entrant to the industry could obtain the capital, intellectual property, and customer base needed to be successful. One method of determining the ease of entry is to examine the composition of the industry over time. If the same firms dominate the industry today as 10 years ago, entry is probably difficult.

High barriers to entry do not necessarily mean firm pricing power is high. Industries with high barriers to entry may have strong price competition when the products sold are undifferentiated or when high barriers to exit result in overcapacity.

Capacity

Industry capacity has a clear impact on pricing power. Undercapacity, a situation in which demand exceeds supply at current prices, results in pricing power. Overcapacity, with supply greater than demand at current prices, will result in downward pressure on price.

Market Share Stability

An analyst should examine whether firms' market shares in an industry have been stable over time. Market shares that are highly variable likely indicate a highly competitive industry in which firms have little pricing power. More stable market shares likely indicate less intense competition in the industry.

Factors that affect market share stability include barriers to entry, introductions of new products and innovations, and the **switching costs** that customers face when changing from one firm's products to another. High switching costs contribute to market share stability and pricing power.

Five Forces that Determine Industry Competition

The analysis framework developed by Michael Porter[1] delineates five forces that determine industry competition.

1. Rivalry among existing competitors.
2. Threat of entry.
3. Threat of substitutes.
4. Power of buyers.
5. Power of suppliers.

Industry competition is less intensive and firm profitability is greater when there is (1) less rivalry among existing industry firms, (2) less threat of new entrants, (3) less threat of

substitute products, (4) less bargaining power of buyers (customers), and (5) less bargaining power of suppliers.

Company Analysis

Having gained understanding of an industry's external environment, an analyst can then focus on **company analysis**. This involves analyzing the firm's financial condition, products and services, and **competitive strategy**. Competitive strategy is how a firm responds to the opportunities and threats of the external environment.

Porter has identified two important competitive strategies that can be employed by firms within an industry: a **cost leadership (low-cost) strategy** or a **product or service differentiation strategy**. According to Porter, a firm must decide to focus on one of these two areas to compete effectively.

In a *low-cost strategy*, the firm seeks to have the lowest costs of production in its industry, offer the lowest prices, and generate enough volume to make a superior return. In **predatory pricing**, the firm hopes to drive out competitors and later increase prices. A low-cost strategy firm should have managerial incentives that are geared toward improving operating efficiency.

In a *differentiation strategy*, the firm's products and services should be distinctive in terms of type, quality, or delivery. For success, the firm's cost of differentiation must be less than the price premium buyers place on product differentiation. The price premium should also be sustainable over time. Successful differentiators will have outstanding marketing research teams and creative personnel.

A company analysis should include the following elements:

- Firm overview, including information on operations, governance, and strengths and weaknesses.
- Industry characteristics.
- Product demand.
- Product costs.
- Pricing environment.
- Financial ratios, with comparisons to other firms and over time.
- Projected financial statements and firm valuation.

A firm's return on equity (ROE) should be part of the financial analysis. The ROE is a function of profitability, total asset turnover, and financial leverage (debt).

EQUITY VALUATION: CONCEPTS AND BASIC TOOLS

Categories of Equity Valuation Models

In **discounted cash flow models** (or **present value models**), a stock's value is estimated as the present value of cash distributed to shareholders (*dividend discount models*) or the present value of cash available to shareholders after the firm meets its necessary capital expenditures and working capital expenses (*free cash flow to equity models*).

There are two basic types of **multiplier models** (or **market multiple models**) that can be used estimate intrinsic values. In the first type, the ratio of stock price to such fundamentals as earnings, sales, book value, or cash flow per share is used to determine if a stock is fairly valued. For example, the price to earnings (P/E) ratio is frequently used by analysts.

The second type of multiplier model is based on the ratio of **enterprise value** to either earnings before interest, taxes, depreciation, and amortization (EBITDA) or revenue. Enterprise value is the market value of all a firm's outstanding securities minus cash and short-term investments. Common stock value can be estimated by subtracting the value of liabilities and preferred stock from an estimate of enterprise value.

In **asset-based models**, the intrinsic value of common stock is estimated as total asset value minus liabilities and preferred stock. Analysts typically adjust the book values of the firm's assets and liabilities to their fair values when estimating the market value of its equity with an asset-based model.

Dividends

Cash dividends transfer cash from the firm to its shareholders, reducing the company's assets and equity. The following are types of cash dividends.

- **Regular dividend.** This is typically paid on a schedule (e.g., quarterly).
- **Extra (or special) dividend.** This is a one-time cash payment to shareholders.

Dividend Payment Chronology

- **Declaration date.** The board of directors approves the dividend payment.
- **Ex-dividend date.** This happens one or two days before the record date depending on the settlement period for trades. It is the first day that a buyer of shares will not receive the next dividend payment. If other things are equal, the market value of shares will fall by the amount of the dividend on the ex-dividend date, leaving shareholder wealth unchanged.
- **Holder-of-record date.** Those who own shares on this date will receive the upcoming dividend.
- **Payment date.** Dividends are paid by check or electronic transfer.

Stock Dividends, Stock Splits, and Reverse Stock Splits

These actions change the number of shares outstanding, but the share price changes proportionately, so a shareholder's wealth and proportional ownership stake are not affected.

- **Stock dividend.** Shareholders receive additional shares of stock (e.g., with a 10% stock dividend, each shareholder receives 10% more shares).
- **Stock split.** Each "old" share is replaced by more than one "new" share (e.g., with a 2-for-1 stock split, investors receive two new shares to replace each share owned).
- **Reverse stock split.** Replaces "old" shares with a smaller number of "new" shares (e.g., with a 1-for-5 reverse stock split, investors receive one new share to replace each five shares they own).

Share Repurchases

A company can buy back shares of its outstanding common stock, an alternative to distributing cash to equity holders through cash dividends. Taxes aside, neither cash dividends nor share repurchases affect the shareholder's wealth.

Preferred Stock Valuation

The dividend is fixed and the income stream (dividends) theoretically continues forever so we use the formula for the present value of a perpetuity.

$$\text{preferred stock value} = \frac{D_p}{k_p}$$

Dividend Discount Models (DDM)

All of the valuation models here are based on taking the present value of expected future cash flows.

One-year holding period:

For the purposes of this valuation model, we assume that dividends are received annually at the end of the year; so, if you hold the stock one year, you will receive the dividend and the estimated sale price P_1. To calculate the present value of these cash flows one year from now:

$$\text{one-period model: } P_0 = \frac{\begin{pmatrix}\text{dividend to}\\ \text{be received}\end{pmatrix}}{(1+k_e)} + \frac{\begin{pmatrix}\text{year-}\\ \text{end price}\end{pmatrix}}{(1+k_e)} \quad \text{or}$$

$$P_0 = \frac{D_1 + P_1}{(1+k_e)}$$

Be sure to use the *expected* dividend, D_1, in the calculation.

Multiple-year holding periods:

With a multiple-year holding period, estimate all the dividends to be received as well as the expected selling price at the end of the holding period.

$$\text{n-period model: } P_0 = \frac{D_1}{(1+k_e)^1} + \frac{D_2}{(1+k_e)^2} + \ldots\ldots + \frac{D_n}{(1+k_e)^n} + \frac{P_n}{(1+k_e)^n}$$

Infinite period model (constant growth model):

We can take the present value of an infinite stream of dividends that grows at a *constant rate* as long as the assumed growth rate, g_c, is less than the appropriate discount rate, k_e.

$$\text{constant growth model: } P_0 = \frac{D_1}{k_e - g_c}, \text{ note that } D_1 = D_0(1 + g_c)$$

Other things held constant, the higher the growth rate and the higher the dividend, the greater the present value.

In practice, however, increasing the dividend will decrease retained earnings and the firm's sustainable growth rate, so we cannot assume that a firm that increases its dividend will increase firm value.

Temporary supernormal growth or multi-stage DDM:

This model assumes that a company's dividends will grow at a high rate for a period of time before declining to a constant growth rate. To calculate the stock price, discount each of the dividends during the high growth period individually and then use the formula for the infinite growth model to find the terminal stock value at the end of the supernormal growth period. Finally, add together the present values of all dividends and of the terminal stock value.

$$\text{value}_{\text{supernormal growth}} = \frac{D_1}{(1 + k_e)} + \frac{D_2}{(1 + k_e)^2} + \ldots + \frac{D_n}{(1 + k_e)^n} + \frac{P_n}{(1 + k_e)^n}$$

D_n is the last dividend of the supernormal growth period.

$$P_n = \frac{D_{n+1}}{k_e - \bar{g}c}, \text{ where } D_{n+1} \text{ is expected to grow at the constant/ normal rate}$$

Earnings multiplier model (P/E ratio):

Understand how the DDM relates to the fundamental P/E ratio.

Start with the DDM and then divide both sides of the equation by next year's projected earnings, E_1:

$$\text{If constant growth DDM holds: } P_0 = \frac{D_1}{k - g} \text{ then } \frac{P_0}{E_1} = \frac{D_1/E_1}{k - g}$$

Other things held constant, the P/E ratio:

- Increases with D_1/E_1, the dividend payout ratio.
- Increases with *g*, the growth rate of dividends.
- Decreases with increases in *k*, the required rate of return.
- Increases with ROE, since *g* = ROE × retention ratio.

  ROE = (net income / sales)(sales / total assets)(total assets / equity)

Problems with using P/E analysis:

- Earnings are historical accounting numbers and may be of differing quality.
- Business cycles may affect P/E ratios. Currently reported earnings may be quite different from expected future earnings (E_1).
- As with the infinite growth model, when k < g, the P/E implied by the DDM is meaningless.

Estimating the Growth Rate in Dividends

To estimate the growth rate in dividends, the analyst can use three methods:

1. Use the historical growth in dividends for the firm.
2. Use the median industry dividend growth rate.
3. Estimate the sustainable growth rate.

The **sustainable growth rate** is the rate at which equity, earnings, and dividends can continue to grow indefinitely assuming that ROE is constant, the dividend payout ratio is constant, and no new equity is issued.

$$\text{sustainable growth} = (1 - \text{dividend payout ratio}) \times \text{ROE}$$

The quantity (1 − dividend payout ratio) is referred to as the **retention rate**, the proportion of net income that is not paid out as dividends and goes to retained earnings, thus increasing equity.

Some firms do not currently pay dividends but are expected to begin paying dividends at some point in the future. A firm may not currently pay a dividend because it is in financial distress and cannot afford to pay out cash, or because the return the firm can earn by reinvesting cash is greater than what stockholders could expect to earn by investing dividends elsewhere.

For firms that do not currently pay dividends, an analyst must estimate the amount and timing of the first dividend in order to use the Gordon growth model. Because these parameters are highly uncertain, the analyst should compare the estimated value from the Gordon growth model with value estimates from other models.

Using Price Multiples to Value Equity

Because the dividend discount model is very sensitive to its inputs, many investors rely on other methods. In a **price multiple** approach, an analyst compares a stock's price multiple to a benchmark value based on an index, industry group of firms, or a peer group of firms within an industry.

Common price multiples used for valuation include price-to earnings, price-to-cash flow, price-to-sales, and price-to-book value ratios. Many of these ratios have been shown to be useful for predicting stock returns, with low multiples associated with higher future returns.

When we compare a price multiple, such as P/E, for a firm to those of other firms based on market prices, we are using price multiples based on comparables. By contrast, price

multiples based on fundamentals tell us what a multiple should be based on some valuation models.

One criticism of price multiples is that they reflect only the past because historical (trailing) data are often used in the denominator. For this reason, many practitioners use forward (leading or prospective) values in the denominator (sales, book value, earnings, etc.) The use of projected values can result in much different ratios. An analyst should be sure to use price multiple calculations consistently across firms.

Trailing P/E uses earnings over the *most recent* 12 months in the denominator. The *leading P/E ratio* (also known as forward or prospective P/E) uses expected earnings for the next four quarters or fiscal year.

$$\text{trailing P/E} = \frac{\text{market price per share}}{\text{EPS over previous 12 months}}$$

$$\text{leading P/E} = \frac{\text{market price per share}}{\text{forecasted EPS over next 12 months}}$$

The *price-to-book (P/B) ratio* is calculated as:

$$\text{P/B ratio} = \frac{\text{market value of equity}}{\text{book value of equity}} = \frac{\text{market price per share}}{\text{book value per share}}$$

A common adjustment is to use *tangible book value*, which is equal to book value of equity less intangible assets (e.g., goodwill, patents).

Furthermore, balance sheets should be adjusted for significant off-balance-sheet assets and liabilities and for differences between the fair and recorded values of assets and liabilities. Finally, book values often need to be adjusted for differences in accounting methods to ensure comparability.

Price-to-sales (P/S) ratios are computed by dividing a stock's price per share by sales or revenue per share or by dividing the market value of the firm's equity by its total sales:

$$\text{P/S ratio} = \frac{\text{market value of equity}}{\text{total sales}} = \frac{\text{market price per share}}{\text{sales per share}}$$

Given one of the definitions of cash flow, the *price-to-cash-flow (P/CF) ratio* is calculated as:

$$\text{P/CF ratio} = \frac{\text{market value of equity}}{\text{cash flow}} = \frac{\text{market price per share}}{\text{cash flow per share}}$$

where:
cash flow = CF, adjusted CFO, FCFE, or EBITDA

Enterprise Value Multiples

Enterprise value (EV) is a measure of total company value and can be viewed as what it would cost to acquire the firm.

$$\text{EV} = \text{market value of common stock} + \text{market value of debt} - \text{cash and short-term investments}$$

Cash and short-term investments are subtracted because an acquirer's cost for a firm would be decreased by the amount of the target's liquid assets. Although an acquirer assumes the firm's debt, it receives the firm's cash and short-term investments. Enterprise value is appropriate when an analyst wants to compare the values of firms that have significant *differences in capital structure*.

EBITDA (earnings before interest, taxes, depreciation, and amortization are subtracted) is probably the most frequently used denominator for EV multiples; operating income can also be used. An advantage of using EBITDA instead of net income is that EBITDA is usually positive even when earnings are not. A disadvantage of using EBITDA is that it often includes non-cash revenues and expenses

Asset-Based Valuation Models

Asset-based models are appropriate when equity value is the market or fair value of assets minus the market or fair value of liabilities. Because market values of firm assets are usually difficult to obtain, the analyst typically starts with the balance sheet to determine the values of assets and liabilities. In most cases, market values are not equal to book values. Possible approaches to valuing assets are to value them at their depreciated values, inflation-adjusted depreciated values, or estimated replacement values.

Applying asset-based models is especially problematic for firms that have a large amount of intangible assets, on or off the balance sheet. The effect of the loss of the current owners' talents and customer relationships on forward earnings may be quite difficult to measure. Analysts often consider asset-based model values as floor or minimum values when significant intangibles, such as business reputation, are involved.

Asset-based model valuations are most reliable when the firm has primarily tangible short-term assets, assets with ready market values (e.g., financial or natural resource firms), or when the firm will cease to operate and is being liquidated.

Advantages and Disadvantages of Valuation Models

Advantages of discounted cash flow models:

- They are based on the fundamental concept of discounted present value and are well grounded in finance theory.
- They are widely accepted in the analyst community.

Disadvantages of discounted cash flow models:

- Their inputs must be estimated.
- Value estimates are very sensitive to input values.

Advantages of comparable valuation using price multiples:

- Evidence that some price multiples are useful for predicting stock returns.
- Price multiples are widely used by analysts.
- Price multiples are readily available.
- They can be used in time series and cross-sectional comparisons.
- EV/EBITDA multiples are useful when comparing firm values independent of capital structure or when earnings are negative and the P/E ratio cannot be used.

Disadvantages of comparable valuation using price multiples:

- Lagging price multiples reflect the past.
- Price multiples may not be comparable across firms if the firms have different size, products, and growth.
- Price multiples for cyclical firms may be greatly affected by economic conditions at a given point in time.
- A stock may appear overvalued by the comparable method but undervalued by a fundamental method, or vice versa.
- Different accounting methods can result in price multiples that are not comparable across firms, especially internationally.
- A negative denominator in a price multiple results in a meaningless ratio. The P/E ratio is especially susceptible to this problem.

Advantages of price multiple valuations based on fundamentals:

- They are based on theoretically sound valuation models.
- They correspond to widely accepted value metrics.

Disadvantages of price multiple valuations based on fundamentals:

- Price multiples based on fundamentals will be very sensitive to the inputs (especially the $k - g$ denominator).

Advantages of asset-based models:

- They can provide floor values.
- They are most reliable when the firm has primarily tangible short-term assets, assets with ready market values, or when the firm is being liquidated.
- They are increasingly useful for valuing public firms that report fair values.

Disadvantages of asset-based models:

- Market values are often difficult to obtain.
- Market values are usually different than book values.

- They are inaccurate when a firm has a high proportion of intangible assets or future cash flows not reflected in asset values.
- Assets can be difficult to value during periods of hyperinflation.

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[1] Michael Porter, "The Five Competitive Forces That Shape Strategy," *Harvard Business Review*, Volume 86, No. 1: pp. 78–93.

FIXED INCOME

Weight on Exam	10% to 12%
SchweserNotes™ Reference	Book 4, Pages 1–139

FIXED-INCOME SECURITIES: DEFINING ELEMENTS

Basic features of fixed income securities include:

- *Issuer*.
- *Maturity date*, also known as a bond's tenor.
- *Par value*, also known as *face value*, *maturity value*, or *redemption value*.
- *Coupon rate*.
- *Coupon frequency*, also known as a bond's **periodicity**.
- *Currency denomination* in which interest and principal will be paid. A **dual-currency bond** pays interest in one currency and principal in another.

The **trust deed** or **indenture** details the issuer's obligations and the bondholder's rights. Legal and regulatory issues addressed include:

- Legal information about the entity issuing the bond.
- Any **collateral** pledged to support repayment of the bond.
  - **Secured bonds** are backed by a claim to specific assets.
  - **Unsecured bonds** represent a claim to the overall assets and cash flows of the issuer.
- **Credit enhancements** increase the probability of repayment and can be internal (built into the structure of a bond issue) or external (provided by a third party).
- **Covenants** describing any actions the firm must take (affirmative covenants) and any actions the firm is prohibited from taking (negative covenants).

A country's **national bond market** includes bonds that trade in that country and are denominated in its currency. These include **domestic bonds** from domestic issuers and **foreign bonds** from foreign issuers.

Eurobonds are issued outside the jurisdiction of any one country and are denominated in a currency different from the currency of the countries in which they are sold.

Global bonds trade in both the eurobond market and a national bond market.

Interest income paid to bondholders is typically taxed as ordinary income at the same rate as wage and salary income. The interest income from most bonds issued by municipal governments in the United States is exempt from federal income tax and income tax in the state of issue.

When a bondholder sells a bond prior to maturity, the transaction may generate a **capital gain** or **loss**, depending on the sale price. Capital gains are often taxed at a lower rate than

ordinary income. If the assets have been owned for more than a specified length of time, they are often taxed at an even lower rate.

Pure-discount bonds and other bonds sold at significant discounts to par when issued are termed **original issue discount (OID)** bonds. The increase in value of OID bonds due to the passage of time may be treated as taxable interest income and, as a result, these bonds can generate a tax liability even though no cash interest payment has been received.

How Fixed Income Cash Flows Are Structured

A typical "plain vanilla" bond has a **bullet structure**. Periodic coupon interest payments are made over the life of the bond, and the principal value is paid with the final interest payment at maturity.

For a bond with an **amortizing structure**, the periodic payments include both interest and some repayment of principal. If a bond is **fully amortizing**, the principal is fully paid off when the last periodic payment is made. A bond can also be structured to be **partially amortizing** so there is a **balloon payment** at bond maturity that includes the unamortized principal.

A **floating-rate note (FRN)** has a coupon rate that is based on a **market reference rate (MRR)** plus (or possibly minus) a margin that reflects the issuer's creditworthiness relative to the reference rate. An **inverse floater** has a coupon rate that increases when the reference rate decreases and decreases when the reference rate increases.

An FRN may have a **cap**, which benefits the issuer by placing a limit on how high the coupon rate can rise. Often, FRNs with caps also have a **floor**, which benefits the bondholder by placing a minimum on the coupon rate, regardless of how low the reference rate falls.

An **index-linked bond** has coupon payments and/or a principal value that is based on a commodity index, an equity index, or some other published index number.

Some index-linked bonds are **principal-protected**, which means they will not pay less than their original par value at maturity, even if the index has decreased.

The most common type of index-linked bonds is **inflation-linked bonds** (or **linkers**) for which payments are based on the change in an inflation index, such as the Consumer Price Index (CPI) in the United States.

The different structures of inflation-indexed bonds include:

- *Indexed-annuity bonds*. Fully amortizing bonds with the periodic payments directly adjusted for inflation or deflation.
- *Indexed zero-coupon bonds*. The payment at maturity is adjusted for inflation.
- *Interest- indexed bonds*. The coupon rate is adjusted for inflation while the principal value remains unchanged.
- *Capital-indexed bonds*. This is the most common structure. An example is U.S. Treasury Inflation Protected Securities (TIPS). The coupon rate remains constant, and the principal value of the bonds is increased by the rate of inflation (or decreased by deflation). TIPS are principal-protected.

Other coupon structures include:

- *Step-up coupon bonds*. The coupon rate increases over time according to a predetermined schedule. These bonds are typically callable.
- *Credit-linked coupon bonds*. The coupon rate increases by a certain amount if the credit rating of the issuer falls, and decreases if the credit rating of the issuer improves.
- *Payment-in-kind bonds*. The issuer may make coupon payments by increasing the principal amount, essentially paying bond interest with more bonds.
- *Deferred coupon (split coupon) bonds*. Regular coupon payments do not begin until a period of time after issuance.

A **sinking fund** provision provides for the periodic retirement of a portion of the bonds issued over the life of the issue. In general, bonds with a sinking fund provision have less credit risk but greater reinvestment risk.

Contingency Provisions in Bonds

A contingency provision describes an action that may be taken if a specific event occurs. Contingency provisions in bond indentures are referred to as **embedded options**. Embedded options may benefit the bond issuer, increasing the required market yield, or benefit the bondholder, decreasing the required market yield. Bonds that do not have contingency provisions are referred to as **straight bonds** or **option-free bonds**.

A **call option** gives the issuer the right to redeem all or part of a bond issue at a specific call price. A **call schedule** specifies a callable bond's **call dates** and call prices. A call price may be par value or include a **call premium** above par. The time from issuance until a callable bond's first call date is referred to as the bond's period of **call protection** (or *lockout period*, *cushion*, or *deferment period*).

The issuer may exercise a call option because market yields have fallen in order to reduce interest expense. Bondholders have more reinvestment risk as a result, as they must reinvest the proceeds of called bonds at lower yields. For this reason, a callable bond must offer a higher yield (sell at a lower price) than an otherwise identical noncallable bond.

To avoid the higher interest rates required on callable bonds but still preserve the option to redeem bonds early for corporate (rather than financial) reasons, issuers have introduced bonds with **make-whole call provisions**. With a make-whole bond, the call price is not fixed but includes a lump-sum payment based on the present value of the future coupons the bondholder will not receive if the bond is called early. Thus, the issuer is unlikely to call the bond except when corporate circumstances, such as an acquisition or restructuring, require it.

There are three styles of exercise for callable bonds. Note that these are only style names and are not indicative of where the bonds are issued:

1. American style—the bonds can be called anytime after the first call date.
2. European style—the bonds can only be called on the call date specified.
3. Bermuda style—the bonds can be called on specified dates after the first call date, often on coupon payment dates.

A **put option** gives the bondholder the right to sell the bond back to the issuing company at a given price, typically par. Bondholders are likely to exercise a put option when the fair

value of the bond is less than the put price because interest rates have risen or the credit quality of the issuer has fallen. Unlike a call option, a put option is exercised by the bondholder so a putable bond will trade at a lower yield (sell at a higher price) relative to an otherwise identical option-free bond.

Convertible bonds give bondholders the option to exchange the bond for a specific number of shares of the issuing corporation's common stock and can have the characteristics of both a debt and equity security as a result. The possibility of profit from increases in the value of the common shares reduces the required yield on the bonds, compared to the yield of an option-free bond. The value of a convertible bond is the value of the bond plus the value of the conversion option.

Contingent convertible bonds (referred to as "CoCos") are bonds that convert from debt to common equity automatically if a specific event occurs and can increase the equity of financial institutions when it falls below the percentage required by regulators.

Sometimes bonds, especially those of riskier, less mature companies, are sold with **warrants** attached. Warrants give their holders the right to buy the firm's common shares at a given price until an expiration date. Warrants provide potential gains to bondholders and do not require the bonds to be retired at exercise, as convertible bonds do.

FIXED-INCOME MARKETS: ISSUANCE, TRADING, AND FUNDING

Primary Market for Bonds

Primary market transactions are sales of newly issued bonds. Bonds can be registered with securities regulators for sale in a **public offering** or sold only to **qualified** investors in a **private placement**. A public offering is typically done with the help of an investment bank, which has expertise in executing a public offering.

In an **underwritten offering**, the investment bank (underwriter), or a **syndicate** of investment banks, purchases the entire bond issue from the issuing firm and then sells them to dealers and investors. Bonds are priced based on indications of interest from buyers. Some bonds are traded on a prior to issue (on a when-issued basis) in what is called the **grey market**, which helps underwriters determine the offering price.

In a **best efforts offering**, the investment banks sell the bonds on a commission basis. Unlike an underwritten offering, the investment banks do not commit to purchase the whole issue.

Some bonds, especially government bonds, are sold through an auction. For example, U.S. Treasury securities are sold through single-price auctions with the majority of purchases made by **primary dealers**.

In a **shelf registration**, a bond issue is registered with securities regulators in its aggregate value with a master prospectus. Portions of the registered issue can then be issued over time when the issuer needs to raise funds. Individual offerings under a shelf registration require less disclosure than a separate registration of a bond issue.

Secondary Market for Bonds

Secondary markets refer to the trading of previously issued bonds. While some government bonds and corporate bonds are traded on exchanges, the great majority of bond trading in the secondary market is made in the dealer, or over-the-counter, market. Dealers post bid (purchase) prices and ask or offer (selling) prices for various bond issues. The difference between the bid and ask prices is the dealer's spread.

Bond trades are cleared through a clearing system, just as equities trades are. Settlement typically occurs on T + 2 or T + 3 for corporate bonds, on T + 1 or cash settlement for government and quasi-government bonds, and cash settlement for some money market securities.

Government and Agency Bonds

National governments or their treasuries issue **sovereign bonds** that are backed by the taxing power of the government. Both a sovereign's ability to collect taxes and its ability to print the local currency lead to higher ratings on bonds issued in the local currency compared to sovereign debt issued in the currency of a developed economy (e.g., USD or euros). Sovereign bonds include fixed-rate, floating-rate, and inflation-indexed bond issues.

Trading is most active and prices most informative for the most recently issued government securities of a particular maturity. These issues are referred to as **on-the-run bonds** or **benchmark bonds**. Yields of other bonds are determined relative to the benchmark yields of sovereign bonds with similar maturities.

Nonsovereign government bonds are issued by states, provinces, counties, and sometimes by entities created to fund and provide services such as for the construction of hospitals, airports, and other municipal services. Payments on the bonds may be supported by the revenues of a specific project, from general tax revenues, or from special taxes or fees dedicated to the repayment of project debt. Nonsovereign bonds are typically of high credit quality, but sovereign bonds typically trade with lower yields because their credit risk is perceived to be less than that of nonsovereign bonds.

Agency bonds or **quasi-government bonds** are issued by entities created by national governments for specific purposes such as financing small businesses or providing mortgage financing. **Supranational bonds** are issued by supranational agencies (also known as multilateral agencies) such as the World Bank, the IMF, and the Asian Development Bank.

Corporate Debt

Bank loans to corporations are typically variable-rate loans. When the loan involves only one bank, it is referred to as a **bilateral loan**. In contrast, when a loan is funded by several banks, it is referred to as a **syndicated loan**.

For larger creditworthy corporations, funding costs can be reduced by issuing short-term debt securities referred to as **commercial paper**. Firms use commercial paper to fund working capital and as a temporary source of funds prior to issuing longer term debt. Debt that is temporary until permanent financing can be secured is referred to as **bridge financing**. To get an acceptable credit rating from the ratings services on their commercial paper, corporations maintain **backup lines of credit** with banks.

Commercial paper is short-term unsecured debt, issued with maturities as short as one day (overnight paper), with most issues maturing in about 90 days. In the United States, commercial paper is issued with maturities of 270 days or less so it is exempt from SEC registration, and is typically issued as a pure discount security.

Eurocommercial paper (ECP) is issued in several countries with maturities as long as 364 days. ECP rates may be quoted as add-on or discount yields.

A bond issue is said to have a **term maturity structure** if all the bonds mature on the same date. An alternative is a **serial bond issue** in which bonds are issued with several maturity dates so a portion of the issue is redeemed periodically. The difference between a serial bond issue and an issue with a sinking fund is that with a serial bond issue, investors know the dates when specific bonds will be redeemed.

In general, corporate bonds are referred to as short-term if they are issued with maturities of up to 5 years, medium-term when issued with maturities from 5 to 12 years, and long-term when maturities exceed 12 years.

Corporations issue debt securities called medium-term notes (MTNs), which are not necessarily medium-term in maturity. MTNs are issued in various maturities, ranging from nine months to periods as long as 100 years. MTNs are offered continuously through agents and can be customized to some extent to match a bond buyer's preferences. Most MTNs, other than long-term MTNs, are issued by financial corporations and most buyers are financial institutions.

Structured Financial Instruments

Structured financial instruments are securities designed to change the risk profile of an underlying debt security, often by combining a debt security with a derivative. Asset-backed securities and collateralized debt obligations are examples of structured financial instruments. Here, we describe several other types with which candidates should be familiar.

A **credit-linked note (CLN)** has regular coupon payments, but its redemption value depends on whether a specific credit event occurs. If the credit event (e.g., a credit rating downgrade or default of a reference asset) does not occur, the CLN will be redeemed at its par value. If the credit event occurs, the CLN will make a lower redemption payment. The yield on a CLN is higher than it would be on the note alone, without the credit link. This extra yield compensates the buyer of the note for taking on the credit risk of the reference asset.

A **capital protected instrument** offers a guarantee of a minimum value at maturity as well as some potential upside gain. One example essentially combines a zero-coupon bond (which will pay the minimum value at maturity) with a call option on a reference stock index. A structured financial instrument that promises a payment equal to its purchase cost is referred to as a **guarantee certificate**.

A **participation instrument** has payments that are based on the value of an underlying interest rate, asset return, or index return. A floating-rate note, based on a market reference rate, is an example.

An **inverse floater** has coupon payments that move oppositely to a reference interest rate, such as coupon payments equal to 8% minus a 180-day MRR. When the reference rate in such a formula is increased by some multiple, it is termed a **leveraged inverse floater**. When the multiplier on the reference rate is less than one, the instrument is termed a **deleveraged inverse floater**.

Funding Alternatives for Banks

Retail customer deposits, including checking accounts, savings accounts, and money market mutual funds, are a short-term funding source for banks. In addition to funds from retail accounts, banks offer interest-bearing certificates of deposit (CDs) in a range of short-term maturities. Non-negotiable CDs cannot be sold.

Negotiable certificates of deposit can be sold. Large denomination (typically more than $1 million) negotiable CDs are an important funding source for banks. They typically have maturities of one year or less and are traded in domestic bond markets as well as in the eurobond market.

Banks may borrow **excess reserves** from other banks in the **central bank funds market**. Rates for these transactions (central bank funds rates) are strongly influenced by the effect of the central bank's open market operations on the money supply and the availability of short-term funds. In the United States, the central bank funds rate is called the **Fed funds rate**.

Other than reserves on deposit with the central bank, funds that are loaned by one bank to another are referred to as **interbank funds**. Interbank funds are loaned between banks for periods of one day to a year. These loans are unsecured and, as with many debt markets, liquidity may decrease severely during times of systemic financial distress.

Repurchase Agreements

In a **repurchase agreement** or **repo**, one party sells a security to a counterparty with a commitment to buy it back at a later date at a specified higher price. The repurchase price is greater than the selling price and the difference is effectively the interest paid to the buyer. In effect, the buyer is lending funds to the seller with the security as collateral. The interest rate implied by the two prices is called the **repo rate**.

A repurchase agreement for one day is called an **overnight repo** and an agreement covering a longer period is called a **term repo**. The interest cost of a repo is customarily less than the rate on bank loans or other short-term borrowing.

A percentage difference between the market value of the security and the amount loaned is called the **repo margin** or the **haircut**. This margin protects the lender in the event that the value of the security decreases over the term of the repo agreement.

Viewed from the standpoint of a bond dealer, a **reverse repo agreement** refers to taking the opposite side of a repurchase transaction, lending funds by buying the collateral security rather than selling the collateral security to borrow funds.

The repo rate is:

- Higher, the longer the repo term.

- Lower, the higher the credit quality of the collateral security.
- Lower when the collateral security is delivered to the lender.
- Higher when the interest rates for alternative sources of funds are higher.

The repo margin is influenced by similar factors. The repo margin is:

- Higher, the longer the repo term.
- Lower, the higher the credit quality of the collateral security.
- Lower, the higher the credit quality of the borrower.
- Lower when the collateral security is in high demand or low supply.

INTRODUCTION TO FIXED-INCOME VALUATION

For an annual-coupon bond with **N** years to maturity:

$$\text{price} = \frac{\text{coupon}}{(1+\text{YTM})} + \frac{\text{coupon}}{(1+\text{YTM})^2} + \ldots + \frac{\text{coupon} + \text{principal}}{(1+\text{YTM})^N}$$

For a semiannual-coupon bond with **N** years to maturity:

$$\text{price} = \frac{\text{coupon}}{\left(1+\frac{\text{YTM}}{2}\right)} + \frac{\text{coupon}}{\left(1+\frac{\text{YTM}}{2}\right)^2} + \ldots + \frac{\text{coupon} + \text{principal}}{\left(1+\frac{\text{YTM}}{2}\right)^{N\times 2}}$$

A bond's price, YTM, coupon rate, and maturity are related as follows:

- Price and YTM are inversely related. An increase in YTM decreases the price and a decrease in YTM increases the price.
- If a bond's coupon rate is greater than its YTM, its price will be at a premium to par value. If a bond's coupon rate is less than its YTM, its price will be at a discount to par value.
- For a bond valued at a discount or premium, the price will converge to par value as the bond approaches maturity, assuming the issuer does not default.
- The percentage decrease in value when the YTM increases by a given amount is smaller than the increase in value when the YTM decreases by the same amount (the price-yield relationship is convex).
- Other things equal, the price of a bond with a lower coupon rate is more sensitive to a change in yield than is the price of a bond with a higher coupon rate.
- Other things equal, the price of a bond with a longer maturity is more sensitive to a change in yield than is the price of a bond with a shorter maturity.

The **constant-yield price trajectory** is the change in value as time passes for a discount or premium bond. It shows how the bond's price would change as time passes if its yield-to-maturity remained constant. If an investor sells a bond before maturity, a capital gain or loss is measured relative to the bond's constant-yield price trajectory.

Bonds can be valued using **spot rates**, which are market discount rates for a single payment to be received in the future. The discount rates for zero-coupon bonds are spot rates. We sometimes refer to spot rates as **zero-coupon rates** or **zero rates**.

The general equation for calculating a bond's value using spot rates (**Si**) is:

$$\text{price} = \frac{\text{coupon}}{(1+S_1)} + \frac{\text{coupon}}{(1+S_2)^2} + \ldots + \frac{\text{coupon} + \text{principal}}{(1+S_N)^N}$$

This price calculated using spot rates is sometimes called the **no-arbitrage price** of a bond because if a bond is priced differently, there will be a profit opportunity from arbitrage among bonds.

The **flat price** of a bond does not include interest accrued between coupon dates. The flat price is also known as a bond's **clean price** or **quoted price**. The **full price** of a bond includes interest accrued between coupon dates and is also known as the **dirty price** or **invoice price**.

Accrued interest since the last payment date can be calculated as the coupon payment times the portion of the current coupon period that has passed, based on actual calendar days (typically used for government bonds) or based on 30-day months and 360-day years (typically used for corporate bonds).

Matrix pricing is a method estimating bond YTMs using the YTMs of traded bonds that have credit quality very close to that of the non-traded or infrequently traded bonds of similar maturity and coupon. For example, the YTM for a non-traded six-year bond can be estimated by taking the average of the YTMs of similar seven-year and five-year bonds.

Yield Measures

The number of bond coupon payments per year is referred to as the **periodicity** of a bond. A bond with a periodicity of 2 will have its yield to maturity quoted on a **semiannual bond basis**. For a given coupon rate, the greater the periodicity, the more compounding periods, and the greater the annual yield.

In general, the annual (effective) yield for bond with its YTM stated for a periodicity of *n*, and *n* compounding periods per year, is:

$$\text{annual yield} = \left(1 + \frac{\text{YTM}}{\text{n}}\right)^{\text{n}} - 1$$

Yields calculated using the stated coupon payment dates are referred to as following **street convention**. When coupon dates fall on weekends and holidays, coupon payments are made the next business day. A yield calculated using these actual coupon payment dates is the **true yield**, which may be slightly lower than a street convention yield.

Current yield (also called **income yield** or **running yield**) is a bond's annual coupon cash flows divided by the bond's flat price. This yield measure does not account for gains or losses as the bond's price moves toward its par value over time.

Simple yield is the sum of the annual coupon payment plus (minus) the straight-line amortization of a discount (premium), divided by the flat price. This yield measure assumes any discount or premium declines evenly over the remaining years to maturity.

For a callable bond, a **yield-to-call** can be calculated for each possible call date and price. The lowest of yield-to-maturity and the various yields-to-call is termed the **yield-to-worst**.

The **option-adjusted yield** for a callable bond is calculated by adding the value of the call option to the bond's flat price. The value of a callable bond is equal to the value of the bond if it did not have the call option, minus the value of the call option. The option-adjusted yield will be less than the yield-to-maturity for a callable bond.

For an FRN, the coupon rate is the reference rate plus or minus a margin based on the credit risk of the bond. Interest is paid in arrears, with the coupon rate for the next period set using the current reference rate.

The margin used to calculate the bond coupon payments is known as the **quoted margin**. The margin required to return the FRN to its par value is the **required margin** (or **discount margin**). When the credit quality of an FRN is unchanged, the quoted margin is equal to the required margin and the FRN returns to its par value at each reset date. If the credit quality of the issuer decreases, the quoted margin will be less than the required margin and the FRN will sell at a discount. If credit quality has improved, the quoted margin will be greater than the required margin and the FRN will sell at a premium.

Yields on money market securities can be stated as a discount from face value or as add-on yields, and can be based on a 360-day or 365-day basis. These securities should be compared based on their **bond equivalent yield**, which is an add-on yield based on a 365-day year.

Yield Curves, Spot Rates, and Forward Rates

A **yield curve** shows yields by maturity. The **term structure of interest rates** refers to the yields at different maturities for like securities or interest rates.

A yield curve for coupon bonds shows the YTMs for coupon bonds at various maturities. A spot rate yield curve or **zero curve** shows the YTMs for zero-coupon bonds at various maturities. A par bond yield curve or **par curve** may be constructed from the spot curve to show the coupon rate that a hypothetical coupon bond at each maturity would need to have to be priced at par.

Forward rates are yields for future periods, such as the rate of interest on a three-year loan that would be made two years from now.

An example of forward rate notation is "2y3y." The "2y" refers to the number of years from today when a loan would begin, and the "3y" refers to the tenor (length) of the loan. Thus, 2y3y is the three-year rate two years from today. Forward rates may also be expressed in months. "6m3m" is a three-month rate beginning six months from today.

A **forward yield curve** shows the future rates for bonds or money market securities for the same maturities for annual periods in the future.

Forward rates and spot rates are related because borrowing for N years should have the same cost as borrowing for shorter periods that add up to N years. For example, borrowing for two years at the two-year spot rate should have the same cost as borrowing for the first year at the one-year spot rate and for the second year at the one-year forward rate one year from now. That is, $(1 + S_2)^2 = (1 + S_1)(1 + 1y1y)$. Based on these relationships between spot and forward rates, we can calculate forward rates from spot rates, calculate spot rates from forward rates, or value a bond using forward rates in the same way we valued a bond using spot rates earlier.

EXAMPLE: Forward rate from spot rates

The two-year spot rate is 5.5% and the three-year spot rate is 6.0%. Calculate the one-year forward rate two years from now (2y1y).

Answer:

$$(1+S_3)^3 = (1 + S_2)^2(1 + 2y1y)$$

$$2y1y = \frac{(1 + S_3)^3}{(1 + S_2)^2} - 1 = \frac{(1.060)^3}{(1.055)^2} - 1 = 7.01\%$$

A quick way to approximate the forward rate is to ignore compounding:

$$3 \times S_3 \approx 2 \times S_2 + 2y1y$$

$$2y1y \approx 3(6.0\%) - 2(5.5\%)$$

$$18\% - 11\% = 7\%$$

EXAMPLE: Spot rate from forward rates

The one-year spot rate is 3.5%. One-year forward rates are: 1y1y = 3.8%, 2y1y = 4.2%, and 3y1y = 4.5%. Calculate the four-year spot rate.

Answer:

The cost of borrowing today for four years should be the same as the cost of a sequence of four one-year loans that begin today and in each of the next three years:

$$(1 + S_4)^4 = (1 + S_1)(1 + 1y1y)(1 + 2y1y)(1 + 3y1y)$$

$$S_4 = [(1.035)(1.038)(1.042)(1.045)]^{1/4} - 1 = 3.9993\%$$

Here, too, we can approximate the result if we ignore compounding:

$$4 \times S_4 \approx S_1 + 1y1y + 2y1y + 3y1y$$

$$S_4 \approx (3.5\% + 3.8\% + 4.2\% + 4.5\%) / 4 = 4.0\%$$

Yield Spreads

A yield spread is the difference between the YTMs of two different bonds. Yield spreads are typically quoted in basis points.

A yield spread relative to a benchmark bond is known as a **benchmark spread**. For fixed-coupon bonds, on-the-run government bond yields for the same or nearest maturity are frequently used as benchmarks. A yield spread over a government bond is also known as a **G-spread**.

An alternative to using government bond yields as benchmarks is to use the fixed rates for interest rate swaps in the same currency and with the same tenor as a bond. Yield spreads relative to swap rates are known as **interpolated spreads** or **I-spreads**.

G-spreads and I-spreads are theoretically correct only if the spot yield curve is flat. However, the spot yield curve is not likely to be flat and is typically upward-sloping. A **zero-**

volatility spread or **Z-spread** is derived by a method that accounts for the shape of the yield curve. The Z-spread is the single spread that, when added to each spot rate, produces a bond value that is equal to the current market value of a bond.

An **option-adjusted spread (OAS)** is used for bonds with embedded options. The OAS is the spread to the spot rate curve that the bond would have if it were option-free. For a callable bond, the OAS is less than the Z-spread and for a putable bond the OAS is greater than the Z-spread. The OAS is the spread that accounts for differences between the liquidity and credit quality of the subject bond and the benchmark, with the effect on yield of any embedded options removed.

INTRODUCTION TO ASSET-BACKED SECURITIES

Securitization refers to a process by which financial assets (e.g., mortgages, accounts receivable, or automobile loans) are purchased by an entity that then issues **asset-backed securities (ABS)** for which the promised payments come from the cash flows from those financial assets.

The primary benefits of the securitization of financial assets are:

1. A reduction in funding costs for firms selling the financial assets to the securitizing entity.
2. An increase in the liquidity of the underlying financial assets.

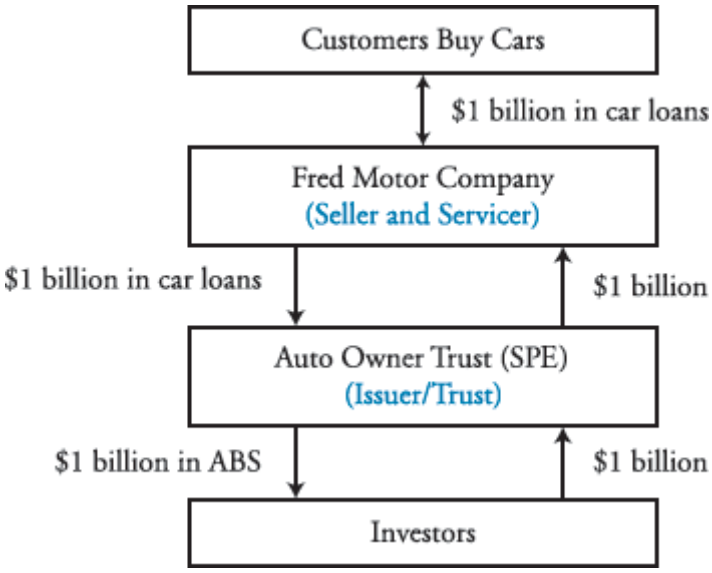
Compared to a bank serving as a financial intermediary between borrowers and lenders, securitization also provides the following benefits:

- Reduced intermediation costs.
- The investors' legal claim to the underlying financial assets is stronger.
- ABS are often actively traded, increasing the liquidity of the originating bank's assets.
- Banks are able to originate more loans compared to relying only on bank funds.
- Allows investors to better match their preferred risk, maturity, and return characteristics.
- Greater diversification and risk reduction compared to individual loans (whole loans).

Parties to a Securitization Transaction and Their Functions

- The **seller** or **depositor** (e.g., bank) originates the loans and sells the portfolio of loans to the **special purpose entity (SPE).**
- The **issuer/trust** is the SPE that buys the loans from the seller and issues ABS to investors.
- The **servicer** collects the payments from the underlying loans and may or may not be the issuer.

Figure 1: Structure of Fred Motor Company Asset Securitization



The ABS of a single SPE may have different priority of claims to the cash flow from the underlying assets, so that the most senior class (tranche) receives its promised payments before the next most senior tranche receives any cash flows, and so on. This is referred to as **time tranching** or a **waterfall structure**.

Because the SPE is legally separate from the seller, financial distress or even bankruptcy of the seller may not affect the credit quality of the ABS. For this reason, the SPE is referred to as **bankruptcy remote** (from the seller). The credit rating of the ABS may be higher than the credit rating of the seller.

ABS are commonly backed by automobile loans, credit card receivables, mortgage and home equity loans, manufactured housing loans, student loans, Small Business Administration loans, corporate loans, corporate bonds, emerging market bonds, and structured financial products. ABS backed by mortgages are termed mortgage-backed securities (MBS).

Residential Mortgage Loans

Mortgage loans have real estate as collateral and typically have original maturities of 15–30 years in the United States and longer in some other countries.

A **fixed-rate mortgage** has an interest rate that is unchanged over the life of the mortgage.

An **adjustable-rate mortgage (ARM)**, or variable-rate mortgage, has an interest rate that can change over the life of the mortgage. An **index-referenced mortgage** has an interest rate that changes based on a market determined reference rate.

A mortgage loan may have a fixed interest rate for some initial period that is adjusted after that. If the loan becomes an adjustable-rate mortgage after the initial fixed-rate period, it is called a **hybrid mortgage.** If the interest rate changes to a different fixed rate after the initial fixed-rate period, it is called a **rollover** or **renegotiable mortgage**.

A **convertible mortgage** is one for which the initial interest rate terms, fixed or adjustable, can be changed at the option of the borrower, to adjustable or fixed, for the remaining loan period.

A **fully amortizing** loan has no outstanding principal after the final payment is made. A **partially amortizing** loan includes some reduction of principal from each payment, but there is a principal payment to be made at maturity as well, called a **balloon** payment. An **interest-only** loan requires the repayment of the entire principal amount of the loan at maturity.

A loan may or may not have a **prepayment penalty**, an extra amount that is due when principal is repaid in greater amounts than scheduled in the loan payments. When there is no prepayment penalty, a decrease in interest rates can allow borrowers to refinance the loan at a lower interest rate and pay off (prepay) the remaining principal on the existing loan.

A prepayment penalty reduces the incentive to repay the loan principal early and protects the lender from receiving additional principal payments when rates are lower and less can be earned from reinvestment of the funds.

With a **non-recourse** loan, the only claim the lender has is to the property, which can be sold and the proceeds up to the amount of the amount owed used to satisfy the loan liability. With a **recourse** loan, the lender has a claim against the assets of the borrower for any excess of the amount owed above the proceeds from the property after it is repossessed and sold.

Residential Mortgage-backed Securities (RMBS)

Agency RMBS are issued by the Government National Mortgage Association (GNMA), the Federal National Mortgage Association (FNMA), and the Federal Home Loan Mortgage Corporation (FHLMC).

GNMA securities are guaranteed and are considered to be backed by the full faith and credit of the U.S. government. FNMA and FHLMC also guarantee the MBS they issue but are **government-sponsored enterprises (GSE)**. Credit quality, while high, is considered slightly lower than that of GNMA securities.

Agency RMBS are **mortgage pass-through** securities in that the interest and principal payments received on the pool of mortgages underlying the MBS are passed along to securities holders in proportion to their ownership of the issue. Because of administrative fees, the **pass-through rate** that investors receive is less than the coupon rates on the underlying mortgages.

The mortgages in the pool typically have different maturities and different mortgage rates. The **weighted average maturity (WAM)** of the pool is equal to the principal-weighted average of the final maturities of all the mortgages in the pool. The **weighted average coupon (WAC)** of the pool is the principal-weighted average of the interest rates of all the mortgages in the pool.

To be included in agency MBS pools, mortgages must be **conforming loans**; that is, they meet certain required criteria including a minimum percentage down payment, a maximum loan-to-value (LTV) ratio, maximum size, minimum documentation required, and insurance purchased by the borrower. Loans that do not meet the standards are called **non-conforming loans** and can be securitized by private companies for **non-agency RMBS**.

The mortgages underlying agency RMBS have no prepayment penalties and are subject to **prepayment risk**. **Extension risk** refers to the risk of receiving principal repayments more slowly than expected, and **contraction risk** refers to the risk of a prepayment rate that is more rapid than expected (principal is returns earlier).

The **conditional prepayment rate (CPR)** is an annualized measure of prepayments. The **Public Securities Association (PSA)** *prepayment benchmark* is expressed as a monthly series of CPRs. A PSA of 50 means that prepayments are 50% of the PSA benchmark CPR, and a PSA of 130 means that prepayments are 130% of the PSA benchmark CPR.

To achieve a credit rating high enough to attract institutional lenders, some form of **credit enhancement** is typically included with ABS. **External credit enhancements** are financial guarantees from third parties that support the performance of the ABS. **Internal credit enhancements** include:

- Reserve funds (either a cash reserve or excess spread of scheduled interest payments from the underlying securities over that promised to ABS holders).
- Overcollateralization (the outstanding principal amount of the ABS is less than that of the underlying securities).
- Senior and subordinated structures (credit risk is shifted from the senior tranche to the subordinated tranche).

Collateralized mortgage obligations (CMOs) are securities that are collateralized by RMBS. Each CMO has multiple tranches, each with a different risk exposure.

With **sequential tranches**, principal repayments flow first to one tranche until its principal balance is repaid and then to the second sequential tranche until its principal value is paid off, and so forth. All tranches receive interest on their beginning-of-period principal values.

A CMO structure can have a **planned amortization class (PAC) tranche** with reduced prepayment risk because **support tranches** take on more prepayment risk. If principal prepayments of the MBS accelerate, the additional payments go to the support tranches and if prepayments are low, principal payments to the support tranches are reduced. Under this structure, the PAC tranche can maintain its promised payment schedule within certain bounds of PSA, and these bounds are the PAC's *initial collar*.

Commercial mortgage-backed securities (CMBS) are backed by income-producing real estate [e.g., apartments (multi-family), warehouses (industrial use property), shopping centers, office buildings, health care facilities, senior housing, or hotel/resort property].

Commercial mortgages are non-recourse loans, so the collateral property's value (ability to generate cash flows) is the only source of repayment of the loans. For this reason, the credit rating for a CMBS is often focused on two measures: the property's **loan-to value (LTV)** ratio and **debt service coverage** ratio.

$$\text{loan-to-value ratio} = \frac{\text{current mortgage amount}}{\text{current appraised value}}$$

$$\text{debt-to-service coverage ratio} = \frac{\text{net operating income}}{\text{debt service}}$$

Either a lower LTV ratio or a higher debt service coverage ratio can increase the credit rating for a CMBS.

Most CMBS have a senior-subordinated structure so that credit risk is first absorbed by the least senior tranche and then by each more senior tranche in turn, as necessary. With this structure, the most senior tranches carry relatively little credit risk, and the lowest priority tranches are quite risky and referred to as the **first-loss tranche** or **equity tranche**.

Call protection (prepayment protection) can be provided for CMBS either at the individual mortgage level or for the CMBS as a whole. Loan level call protection, in various amounts, can be provided by:

- A **prepayment lockout period** of three to five years, during which the loan cannot be prepaid.
- **Defeasance:** any prepayments are used to purchase Treasury securities that will generate cash flows to make future loan payments.
- **Prepayment penalty:** a percentage of the principal amount that must be paid if the loan is paid off early.
- **Yield maintenance (make whole) charges** require an extra payment in the event of an early loan payoff that fully compensates lenders from losses due to early retirement of principal in a lower interest rate environment.

Call protection at the CMBS level is sometimes provided with a senior-subordinated structure so that lower priority tranches receive prepayments first and are first to absorb losses from defaults on the underlying mortgages.

Non-Mortgage ABS

Auto loan ABS are backed by automobile loans, which are typically fully amortizing but with shorter maturities than residential mortgages. Prepayments result when autos are sold or traded in, stolen or wrecked and paid off from insurance proceeds, refinanced, or paid off early by the borrower.

Credit card ABS are backed by credit card receivables, which are revolving debt (non-amortizing). Credit card ABS typically have an initial **lockout period** (of as long as 10 years) during which only interest is paid to investors, and all principal payments on the receivables are used to purchase additional receivables. Credit card ABS can be fixed-rate or floating-rate securities.

Collateralized Debt Obligations

Collateralized debt obligations (CDOs) are structured securities backed by a pool of debt obligations that is managed by a collateral manager. CDOs include:

- Collateralized bond obligations (CBOs) backed by corporate and emerging market debt.
- Collateralized loan obligations (CLOs) backed by leveraged bank loans.
- Structured finance CDOs backed by residential or commercial MBS, ABS, or other CDOs.
- Synthetic CDOs backed by credit default swaps on structured securities.

CDOs issue three classes of bonds (tranches): senior bonds, mezzanine bonds, and subordinated bonds (sometimes called the equity or residual tranche). The subordinated

tranche has characteristics more similar to those of equity investments than bond investments.

An investment in the equity or residual tranche can be viewed as a leveraged investment where borrowed funds (raised from selling the senior and mezzanine tranches) are used to purchase the debt securities in the CDO's collateral pool.

The collateral manager may use interest earned on portfolio securities, cash from maturing portfolio securities, and cash from the sale of portfolio securities to cover the promised payments to holders of the CDO's senior and mezzanine bonds. Any excess above that flows to the equity tranche.

In an **arbitrage CDO**, the return promised to the CDO securities is less than the promised return on the underlying securities, so that in the absence of default, this excess return is the cash flow to the residual tranche.

Covered Bonds

Covered bonds are similar to asset-backed securities, but the underlying assets remain on the balance sheet of the issuing corporation (i.e., no SPE is created). Special legislation protects these assets in the event of firm insolvency (they are bankruptcy remote).

In contrast to an SPE structure, covered bonds provide bondholders with recourse to the issuing firm in the event the underlying assets do not produce sufficient cash flows. This increases their credit quality, so covered bonds generally have lower yields than comparable ABS. Unlike ABS, a covered bond requires the issuer to replace or augment nonperforming or prepaid assets to further ensure that promised bond payments will be made.

UNDERSTANDING FIXED-INCOME RISK AND RETURN

The three sources of returns from investing in a fixed-rate bond are:

1. Coupon and principal payments.
2. Interest earned on reinvested coupon payments.
3. Capital gain or loss if the bond is sold prior to maturity.

For a bond that does not default, and assuming the rate earned on reinvested coupons is equal to the YTM:

- An investor who holds a fixed-rate bond to maturity will earn an annualized rate of return equal to the YTM of the bond when purchased.
- An investor who sells a bond prior to maturity will earn a rate of return equal to the YTM at purchase if the bond's YTM when sold is equal to the YTM of the bond when purchased.

If the YTM of the bond decreases (increases) shortly after issuance:

- An investor who sells the bond in the short term will have an increased (decreased) return due to the increase (decrease) in the sale price of the bond.

- An investor who holds the bond to maturity (or other suitably long term) will have a decreased (increased) return due to the decreased (increased) reinvestment income earned.

These results illustrate the trade-off between *market price risk* (the uncertainty about price due to uncertainty about market YTM) and *reinvestment risk* (uncertainty about the total of coupon payments and reinvestment income on those payments due to the uncertainty about future reinvestment rates). For an investor with a short investment horizon, market price risk is greater than reinvestment risk. For an investor with a long investment horizon, reinvestment risk is greater than market price risk.

The investment horizon at which these risks just offset is known as a bond's **Macaulay duration**. A bond's annual Macaulay duration is calculated as the weighted average of the number of years until each of the bond's promised cash flows is to be paid, where the weights are the present values of each cash flow as a percentage of the bond's full value. For a semiannual-pay bond, Macaulay duration is calculated as a number of semiannual periods and divided by two to get the annual Macaulay duration.

The difference between a bond's Macaulay duration and the bondholder's investment horizon is referred to as a **duration gap**. A positive duration gap (Macaulay duration greater than the investment horizon) exposes the investor to market price risk from increasing interest rates. A negative duration gap (Macaulay duration less than the investment horizon) exposes the investor to reinvestment risk from decreasing interest rates.

Modified duration is calculated as Macaulay duration divided by one plus the bond's yield to maturity. Modified duration provides an approximate percentage change in a bond's price for a 1% change in yield to maturity. For a given change in YTM, the price change can be calculated as:

$$\text{approximate percentage change in bond price} = -\text{modified duration} \times \Delta\text{YTM}$$

We can approximate modified duration directly using bond values for an increase and for a decrease in YTM of the same size:

$$\text{approximate modified duration} = \frac{V_- - V_+}{2 \times V_0 \times \Delta\text{YTM}}$$

where:
V_0 = the initial price
V_- = the price of the bond if YTM is decreased by ΔYTM
V_+ = the price of the bond if the YTM is increased by ΔYTM

Modified duration is not appropriate for bonds with embedded options because their future cash flows may change depending on the level and path of interest rates. For these bonds, we use **effective duration**, which uses the change in the benchmark yield curve, rather than the change in YTM, to generate V_- and V_+:

$$\text{effective duration} = \frac{V_- - V_+}{2 \times V_0 \times \Delta\text{curve}}$$

Other things equal, a bond's interest rate risk (as measured by duration) is:

- Usually greater with a longer maturity. We must say “usually” because there are instances where an increase in a discount coupon bond’s maturity will decrease its Macaulay duration.
- Less with a higher coupon rate. When more of a bond’s value will be from payments received sooner, the value of the bond is less sensitive to changes in yield.
- Less with a higher YTM. This is because the price-yield relationship is convex. At lower yields, the price-yield curve has a steeper slope, indicating that price is more sensitive to a given change in yield.
- Less with an embedded call or put option.

The duration concept may be applied to a bond portfolio. There are two approaches to estimating **portfolio duration**:

1. Calculate the weighted average number of periods until the portfolio’s cash flows will be received. This approach is theoretically correct but is not often used in practice, and cannot be used if some portfolio bonds have embedded options.
2. Take a weighted average of the durations of the individual bonds in the portfolio, where the weights are the full price of each bond as a proportion of the total portfolio value. A limitation of this approach is that it assumes a parallel shift in the yield curve but the effective duration of bonds with embedded options can be used.

The **money duration** (also called **dollar duration**) of a bond position is expressed in currency units. Multiplying the money duration of a bond times a given change in YTM will provide an estimate of the change in bond value for that change in YTM. Money duration is sometimes expressed as money duration per 100 currency units of bond par value.

Duration is an adequate measure of bond price risk only for parallel shifts in the yield curve. The impact of nonparallel shifts can be measured using **key rate duration**. A key rate duration is the sensitivity of the value of a bond or portfolio to changes in the spot rate for a specific maturity, holding other spot rates constant. A bond or portfolio will have a key rate duration for each maturity range on the spot rate curve.

The **price value of a basis point (PVBP)** is the money change in the full price of a bond when its YTM changes by one **basis point**, or 0.01%. We can calculate the PVBP directly by calculating the average of the decrease in the full value of a bond when its YTM increases by one basis point and the increase in the full value when its YTM decreases by one basis point.

Because modified duration is a linear approximation of the relationship between yield and price, duration-based estimates of a bond’s full price become increasingly poor for larger changes in YTM. Estimates of the price impact of a change in yield can be improved by including **convexity**, a measure of the curvature of the price-yield relation. A bond’s convexity can be estimated as:

$$\text{approximate convexity} = \frac{V_- + V_+ - 2V_0}{(\Delta\text{YTM})^2 \times V_0}$$

Effective convexity, like effective duration, must be used for bonds with embedded options.

$$\text{effective convexity} = \frac{V_- + V_+ - 2V_0}{(\Delta\text{curve})^2 \times V_0}$$

The estimated price change including the convexity adjustment is:

$$\begin{aligned}&\text{change in full bond price}\\&= -(\text{annual modified duration})(\Delta\text{YTM}) + (1/2)(\text{annual}\\&\quad\text{convexity})(\Delta\text{YTM})^2\end{aligned}$$

While the convexity of any option-free bond is positive, the convexity of a callable bond can be negative at low yields. The call price puts an effective limit on increases in bond value because at low yields the bond is likely to be called. For a bond with negative convexity, the price increase from a decrease in YTM is smaller than the price decrease from an increase in YTM.

Bondholders prefer greater convexity, other things equal. A bond with greater convexity is more price-sensitive to decreases in YTM, and less price-sensitive to increases in YTM, than a bond with less convexity. That is, with greater convexity a bond's price will increase more, and decrease less, in response to a given change in YTM.

In calculating duration and convexity, we implicitly assume the yield curve shifts in a parallel manner. In practice, this is often not the case. A shorter term bond can have more price volatility than a longer term bond with a greater duration if the volatility of the shorter term yield is greater. The **term structure of yield volatility** refers to the relation between the volatility of bond yields and their times to maturity.

Empirical and Analytical Duration

Duration measures of bond price sensitivity to changes in yields based on mathematical analysis are referred to as **analytical durations**. A different approach is to estimate **empirical durations** using the historical relationship between benchmark yield changes and changes in the yield spread for corporate bonds.

Corporate bond durations based on a shift in the government yield curve implicitly assume the credit spread for the corporate bond remains unchanged. When this assumption is not justified, estimates of empirical duration based on the actual relationship between changes in the benchmark yield curve and changes in yield spreads may be more appropriate.

An example of such a situation is a "flight to quality," when yields on government bonds decrease but credit spreads increase at the same time. As a result, government bond prices increase but corporate bond prices increase by less or possibly not at all. For a corporate bond portfolio, an estimate of empirical duration that accounts for this effect would be lower (i.e., less price response to a decrease in benchmark yields) than an estimate of analytical duration would indicate.

FUNDAMENTALS OF CREDIT ANALYSIS

Credit risk refers to potential losses from the failure of a borrower to make promised payments and has two components: default risk and loss severity. **Default risk** is the

probability that a borrower will fail to pay interest or principal when due. **Loss severity** refers to the value (in money or as a percentage) that a bond investor will lose if the issuer defaults.

The **expected loss** is equal to the default risk multiplied by the loss severity. Percentage loss severity is equal to one minus the **recovery rate**, the percentage of a bond's value an investor will receive if the issuer defaults.

Bonds with greater credit risk trade at higher yields than bonds thought to be free of credit risk. The difference in yield between a credit-risky bond and a credit-risk-free bond of similar maturity is called its **yield spread**. Bond prices decrease when their yield spreads increase.

The yield spread also compensates investors for liquidity risk. **Market liquidity risk** is the risk of receiving less than market value when selling bonds and is reflected in their bid-ask spreads. **Downgrade risk** refers to the risk that spreads will increase because the issuer has become less creditworthy so its credit rating is lowered.

The priority of a bond's claim to the issuer's assets and cash flows is referred to as its **seniority ranking**. Secured debt is backed by collateral, while unsecured debt (debentures) is a general claim against the issuer.

The seniority (and recovery rate) rankings for various types of debt securities (highest priority to lowest) are:

- First lien/senior secured.
- Second lien/secured.
- Senior unsecured.
- Senior subordinated.
- Subordinated.
- Junior subordinated.

All debt securities in the same category have the same priority and are said to rank **pari passu**. Strict priority of claims is not always applied in practice. In a bankruptcy, the court may approve a reorganization plan that does not strictly conform to the priority of claims.

Credit Ratings

Credit rating agencies assign ratings to corporate issuers based on the creditworthiness of their senior unsecured debt ratings, referred to as **corporate family ratings (CFR)**, and to individual debt securities, referred to as **corporate credit ratings (CCR)**. Higher ratings indicate a lower expected default rate. **Notching** is the practice of assigning different ratings to bonds of the same issuer.

Figure 2 shows ratings scales used by Standard & Poor's, Moody's, and Fitch. Bonds with ratings of Baa3/BBB– or higher are considered **investment grade**. Bonds rated Ba1/BB+ or lower are considered non-investment grade and are often called **high-yield bonds** or **junk bonds**.

Figure 2: Credit Rating Categories

(a) Investment grade ratings	
Moody's	*Standard & Poor's, Fitch*
Aaa	AAA
Aa1	AA+
Aa2	AA
Aa3	AA–
A1	A+
A2	A
A3	A–
Baa1	BBB+
Baa2	BBB
Baa3	BBB–

(b) Non-investment grade ratings	
Moody's	*Standard & Poor's, Fitch*
Ba1	BB+
Ba2	BB
Ba3	BB–
B1	B+
B2	B
B3	B–
Caa1	CCC+
Caa2	CCC
Caa3	CCC–
Ca	CC
C	C
C	D

In a holding company structure, a subsidiary's debt covenants may prohibit the transfer of cash or assets to the parent until after the subsidiary's debt is serviced. The parent company's bonds are thus effectively subordinated to the subsidiary's bonds. This is referred to as **structural subordination** and is considered by rating agencies when notching an issue credit rating.

Relying on ratings from credit rating agencies has risks. Credit ratings change over time and ratings mistakes happen. Event risks specific to a company or industry such as natural disasters, acquisitions, and equity buybacks using debt, are difficult to anticipate and therefore not easily captured in credit ratings. Finally, changes in yield spreads and bond prices anticipate ratings changes and reflect expected losses, while ratings are based solely on default risk.

Credit Analysis

One way to represent the key components of credit analysis is by the **four Cs** of credit analysis: *capacity*, **collateral**, **covenants**, and **character**. *Capacity* refers to a corporate borrower's ability repay its debt obligations on time. *Collateral* refers to the value of a borrower's assets. *Covenants* are the terms and conditions the borrowers and lenders agree to as part of a bond issue. **Character** refers to management's integrity and its commitment to repay.

Capacity to repay is assessed by examining: (1) industry structure, (2) industry fundamentals, and (3) company fundamentals. Industry structure can be described by Porter's five forces: rivalry among existing competitors, threat of new entrants, threat of substitute products, bargaining power of buyers, and bargaining power of suppliers. Analysis of industry fundamentals focuses on industry cyclicality (more cyclicality indicates greater credit risk) and growth prospects (earnings growth indicates less credit risk). Company fundamentals include competitive position, operating history, management's strategy and execution, and leverage and coverage ratios.

Collateral analysis is more important for less creditworthy companies. The market value of a company's assets can be difficult to observe directly. High depreciation expense relative to capital expenditures may signal that management is not investing sufficiently and the quality of the company's assets may be poor. Some intangible assets that can be sold to generate cash flows, such as patents, are considered high-quality collateral, whereas goodwill is not considered a high-quality, intangible asset.

Covenants protect lenders while leaving some operating flexibility to the borrowers to run the company. **Affirmative covenants** require the borrower to take certain actions, and are typically for administrative purposes. **Negative covenants** restrict the borrower from taking certain actions that may reduce the value of the bondholders' claims. While affirmative covenants do not impose significant costs on the issuer (besides making the promised payments), negative covenants constrain the issuer's business activities and may impose significant costs on the issuer.

Character analysis includes an assessment of management's ability to develop a sound strategy; management's past performance in operating the company without bankruptcies or restructurings; accounting policies and tax strategies that may be hiding problems, such as revenue recognition issues, frequent restatements, and frequently changing auditors; any record of fraud or other legal and regulatory problems; and prior treatment of bondholders, such as benefits to equity holders at the expense of debt holders through debt-financed acquisitions and special dividends.

Financial Ratios Used in Credit Analysis

Profit and cash flow metrics commonly used in ratio analysis include earnings before interest, taxes, depreciation, and amortization (EBITDA); funds from operations (FFO), which is net income from continuing operations plus depreciation, amortization, deferred taxes, and noncash items; free cash flow before dividends; and free cash flow after dividends.

Two primary categories of ratios for credit analysis are leverage ratios and coverage ratios. The most common measures of leverage used by credit analysts are the debt-to-capital ratio, the debt-to-EBITDA ratio, the FFO-to-debt ratio, and the FCF after dividends-to-debt ratio. The most commonly used coverage ratios are EBITDA-to-interest and EBIT-to-interest. When calculating ratios, analysts should adjust debt reported on the financial statements by including the firm's obligations, such as underfunded pension plans (net pension liabilities), and off-balance-sheet liabilities, such as operating leases. In general, higher coverage ratios and lower leverage ratios are associated with higher credit quality. A firm's ratios are compared to benchmark ratios in determining its overall credit rating.

Yield Spreads

A bond's yield spread is primarily affected by five interrelated factors: the credit cycle, economic conditions, financial market performance, broker-dealer capital, and general market demand and supply. Yield spreads on lower-quality issues tend to be more volatile than spreads on higher-quality issues.

High-Yield Debt

Reasons for non-investment grade ratings may include high leverage; unproven operating history; low or negative free cash flow; high sensitivity to business cycles; low confidence in management; unclear competitive advantages; large off-balance-sheet liabilities; or an industry in decline.

Special considerations for high-yield bonds include their liquidity, projections of earnings and cash flow, debt structure, corporate structure, and covenants.

Sources of liquidity (in order of reliability) include:

1. Balance sheet cash.
2. Working capital.
3. Operating cash flow.
4. Bank credit.
5. Issuing equity.
6. Sales of assets.

To understand difficulties firms may have in meeting their debt payments, analysts should include stress scenarios when forecasting future earnings and cash flows and consider the effects of possible changes in capital expenditures and working capital investment.

High yield issuers' capital structures often include different types of debt with several levels of seniority and hence varying levels of potential loss severity. Companies for which secured bank debt is a high proportion of the capital structure are said to be **"top heavy"** and have less capacity to borrow from banks in financially stressful periods. When an issuer has multiple layers of debt with a variety of expected recovery rates, a credit analyst should calculate leverage for each level of the debt structure.

Many high-yield companies use a holding company structure so that structural subordination can lead to lower recovery rates for the parent company's debt.

Important covenants for high-yield debt may include a **change of control put** that gives debt holders the right to require the issuer to buy back debt in the event of an acquisition; restricted payments to equity holders; limitations on liens; and **restricted subsidiaries**. Restricted subsidiaries' cash flows and assets are designated to service the debt of the parent holding company. This benefits creditors of holding companies because their debt is pari passu with the debt of restricted subsidiaries, rather than structurally subordinated.

Sovereign and Non-Sovereign Government Debt

Sovereign debt is issued by national governments. Sovereign credit analysis must assess both the government's *ability* to service debt and its *willingness* to do so. Willingness is important because bondholders usually have no legal recourse if a national government refuses to pay its debts.

A basic framework for evaluating and assigning a credit rating to sovereign debt includes five key areas:

1. **Institutional assessment** includes successful policymaking, minimal corruption, checks and balances among institutions, and a culture of honoring debts.

2. **Economic assessment** includes growth trends, income per capita, and diversity of sources for economic growth.
3. **External assessment** includes the country's foreign reserves, its external debt, and the status of its currency in international markets.
4. **Fiscal assessment** includes the government's willingness and ability to increase revenue or cut expenditures to ensure debt service, as well as trends in debt as a percentage of GDP.
5. **Monetary assessment** includes the ability to use monetary policy for domestic economic objectives (this might be lacking with exchange rate targeting or membership in a monetary union) and the credibility and effectiveness of monetary policy.

Credit rating agencies assign each national government a **local currency debt rating** and a **foreign currency debt rating**. Foreign currency debt typically has a higher default rate and a lower credit rating because the government must purchase foreign currency in the open market to make payments. In contrast, local currency debt can be repaid by simply printing more currency. Ratings can differ as much as two notches for local currency and foreign currency bonds.

Municipal bonds are issued by state and local governments or their agencies. Municipal bonds usually have lower default rates than corporate bonds with same credit ratings. Most municipal bonds can be classified as general obligation bonds or revenue bonds. **General obligation** (GO) **bonds** are unsecured bonds backed by the full faith and credit (taxing power) of the issuer. **Revenue bonds** finance specific projects. Revenue bonds often have higher credit risk than GO bonds because the project is the sole source of funds to service the debt.

Municipal governments' ability to service their general obligation debt depends ultimately on the local economy. Economic factors to assess include employment, trends in per capita income and per capita debt, tax base, demographics, and ability to attract new jobs. Credit analysts must also observe revenue variability through economic cycles. Relying on tax revenues that are highly variable over an economic cycles indicate higher credit risk. Municipalities may have underfunded long-term obligations such as pension and other post-retirement benefits.

Analysis of revenue bonds requires both analysis of the project and analysis of the financing structure of the project. A key metric for revenue bonds is the **debt service coverage ratio**, which is the ratio of the project's net revenue to the required interest and principal payments on the bonds.

DERIVATIVES

Weight on Exam	5% to 8%
SchweserNotes™ Reference	Book 4, Pages 141–221

DERIVATIVE INSTRUMENT AND DERIVATIVE MARKET FEATURES

A **derivative** obtains its value from the value of another security, interest rate, index value, or another variable at a specific future date. We call that security or variable the **underlying** of a derivative.

One example of a derivative is a **forward contract**, in which one party agrees to buy (and the counterparty agrees to sell) the underlying for a specified price (the **forward price**) on a specified future date (the **settlement date** or **expiration date**).

We can view a derivative contract as a way to transfer risk. For example, selling a forward contract on shares of stock effectively locks in a future price and transfers price risk to the forward buyer. We say the seller has **hedged** (reduced or eliminated) their stock price risk. If the buyer has no existing price risk before entering the forward contract, we say they are **speculating** as opposed to hedging.

If the risk offset by a derivative exactly matches an existing risk, we say the derivative creates a **full hedge** of the existing risk. If a derivative reduces an existing risk but does not eliminate it, we say it creates a **partial hedge**.

A derivative may be a **deliverable contract**, in which the parties actually exchange the underlying at settlement, or a **cash-settled contract**, in which the parties exchange only the gains and losses at settlement. Ignoring transactions costs, we say that delivery and cash settlement are economically equivalent.

Derivatives have potential advantages over cash market transactions:

- Investors can gain exposure to a risk at low cost through derivatives.
- Transaction costs may be significantly lower for a derivatives position than for a cash market transaction.
- If a cash market transaction would have a significant impact on the underlying price, taking a derivatives position may be a lower-cost alternative.

Forwards, most swaps, and some options are **over-the-counter derivatives**, which are custom instruments created and traded by dealers in a market with no central location. Over-the-counter markets are largely unregulated and less transparent than exchange markets. In over-the-counter markets with no central clearinghouse, each side of a trade faces **counterparty credit risk**, which is the risk that the other party to the trade does not fulfill its obligations.

Exchange-traded derivatives are standardized and backed by a central clearinghouse, which effectively takes the opposite position to each side of a trade (called **novation**) and guarantees the payments promised under the contract. This effectively eliminates counterparty credit risk for both parties to a contract.

After the financial crisis of 2008, regulators worldwide instituted a **central clearing mandate** for many swap trades, requiring that a central counterparty take on the counterparty credit risk of both sides of a trade, similar to the role of a central clearinghouse.

FORWARD COMMITMENT AND CONTINGENT CLAIM FEATURES AND INSTRUMENTS

A **forward commitment** is a legally binding promise to perform some action in the future. Derivatives that are forward commitments include forward contracts, futures contracts, and most swaps. By contrast, a **contingent claim** to a payoff depends on a future event. Derivatives that are contingent claims include options and credit default swaps.

Forward Contracts

In a forward contract between two parties, one party commits to buy and another party commits to sell an underlying at a specific price on a specific date in the future. The forward price is typically set such that the contract has zero value to either party at inception.

The buyer of the forward gains when the price of the underlying increases and loses when it decreases (similar to a long position in the underlying). We say the forward buyer has **long exposure** to the underlying and the forward seller has **short exposure** to the underlying.

Futures Contracts

A futures contract is quite similar to a forward contract, but it is standardized and exchange traded. Futures differ from most forwards in that they trade in liquid markets, are regulated more strictly, and offer greater transparency.

On a futures exchange, both the buyer and seller must deposit **margin**, which protects the clearinghouse from counterparty risk. Based on the settlement price of the futures at the end of each trading day, the clearinghouse adjusts the margin accounts of both buyers and sellers for gains and losses. This is known as **marking to market**.

Initial margin is the amount of cash or collateral that a party must deposit before entering a futures position. **Maintenance margin** is the minimum amount the party must have in the margin account to keep a futures position. If the balance in the account falls below the maintenance margin, the party must bring the margin balance back up to the *initial* margin amount or close out the futures position. (Note the difference from equity trading, where a margin call only requires bringing the account back up to the *maintenance* level.)

Each day's **settlement price** for a futures contract is the average price of trades over a period at the end of the trading session. Many futures exchanges impose **price limits** on how much each day's settlement price can differ from the previous day's price. Some

exchanges have **circuit breakers** that suspend trading for short periods when a futures price changes by a specific amount.

Swap Contracts

Swaps are agreements to exchange a series of payments on multiple settlement dates over a specified period, such as quarterly payments for two years.

In a simple **fixed-for-floating interest rate swap**, the contract specifies a **notional principal** amount, a fixed interest rate (the **swap rate**) that determines the payments of the **fixed-rate payer**, and a **market reference rate (MRR)** that determines the payments of the **floating-rate payer**. Typically, the two payments are netted so that the party owing the greater payment pays the difference to the counterparty.

The swap rate is set so that the swap has zero value to each party at its inception. As expectations of future values of the MRR change over time, the value of the swap will become positive for one party and negative (in an equal amount) for the other party.

A company with a floating-rate note outstanding can effectively convert it to a fixed-rate liability by entering a swap as the fixed-rate payer (floating-rate receiver). The payments from the floating-rate payer essentially cover the interest owed on the company's floating-rate note, and the company makes fixed interest payments.

In a **credit default swap (CDS)**, one party makes fixed periodic payments in exchange for a payment to be made if there is a **credit event**, such as a default, on an underlying reference security. If a credit event occurs, the protection seller must pay an amount that offsets the loss in value of the reference security. This is similar to insuring a bond against default.

The holder of a risky bond can hedge its default risk by entering a CDS as the protection buyer. The protection seller receives the default risk premium, or credit spread, and takes on the risk of default, resulting in risk exposure similar to that of holding the reference bond. The protection buyer essentially pays the credit spread on the reference security for insurance against default.

Options

An **option** contract gives its owner the right, but not the obligation, to either buy or sell an underlying asset at a given price (the **exercise price** or **strike price**). The option buyer can choose whether to exercise an option, whereas the seller is obligated to perform if the buyer exercises the option. There are four possible options positions:

1. Long call: the buyer of a call option—has the right to buy an underlying asset.
2. Short call: the writer (seller) of a call option—has the obligation to sell the underlying asset.
3. Long put: the buyer of a put option—has the right to sell the underlying asset.
4. Short put: the writer (seller) of a put option—has the obligation to buy the underlying asset.

The price of an option is also referred to as the **option premium**.

American options may be exercised at any time up to and including the contract's expiration date.

European options can be exercised only on the contract's expiration date.

Call Option Payoff Diagrams

The following graph illustrates the payoff at expiration for a call option as a function of the stock price, for both buyers and writers. Note that this differs from the *profit diagram* that follows in that the profit diagram reflects the initial cost of the option (the *premium*). Remember that the option buyer pays the premium to the option seller and if the option finishes out of the money, the writer keeps the premium and the buyer loses the premium. Options are considered a *zero-sum game* because whatever amount the buyer gains, the seller loses, and vice versa.

> intrinsic value of a call option = max[0, S – X]
> intrinsic value of a put option = max[0, X – S]

Figure 1: Call Option Payoff Diagram

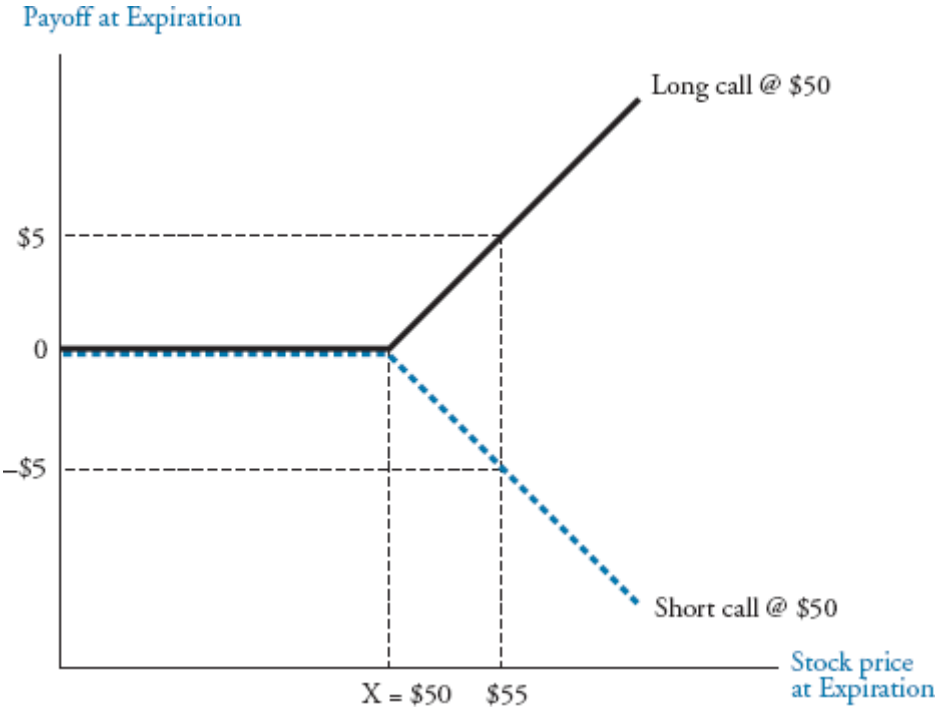
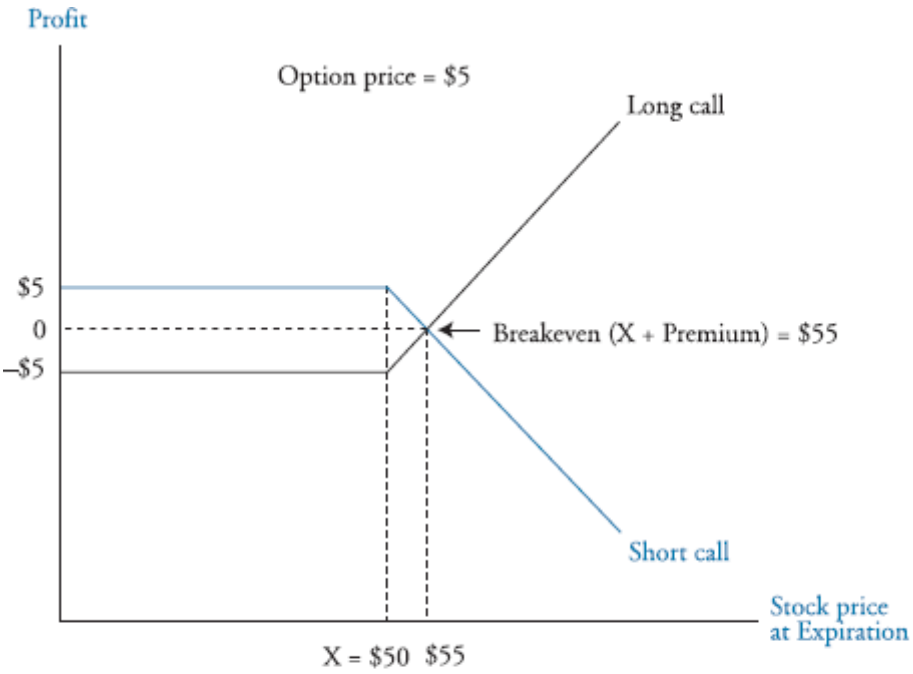


Figure 2: Profit/Loss Diagram for a Call Option

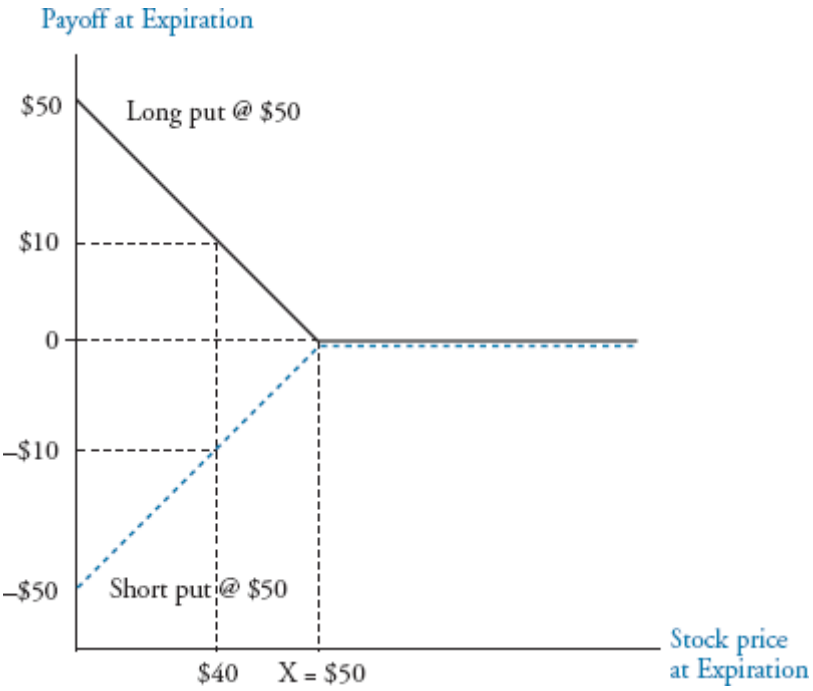


	Call Option	
	Maximum Loss	**Maximum Gain**
Buyer (long)	Premium	Unlimited
Seller (short)	Unlimited	Premium
Breakeven	X + premium	

Put Option Diagrams

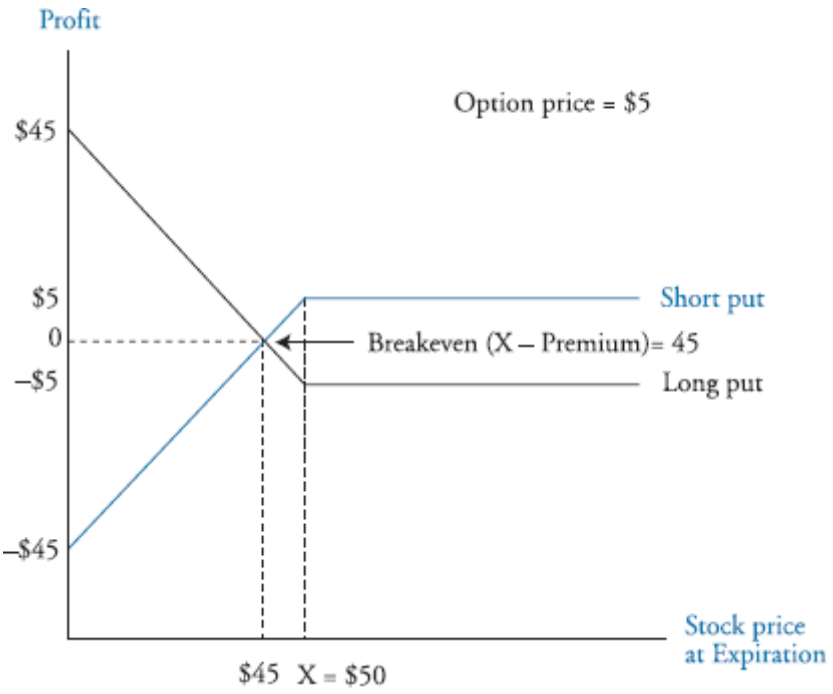
The following graph illustrates the payoff at expiration for a put option as a function of stock price, for both buyers and writers.

Figure 3: Put Option Payoff Diagram



Note that in the *profit diagram* that follows, the cost of the option (the *premium*) is included.

Figure 4: Profit/Loss Diagram for a Put Option



	Put Option	
	Maximum Loss	**Maximum Gain**
Buyer (long)	Premium	X – premium
Seller (short)	X – premium	Premium
Breakeven	X – premium	

DERIVATIVE BENEFITS, RISKS, AND ISSUER AND INVESTOR USES

Benefits of derivatives, compared to cash market transactions, include:

- Managing risks, transferring risks, and changing risk allocations.
- Creating risk exposures that are not available in cash markets, such as one-sided exposures with options.
- Information discovery, such as expected future prices, interest rates, or volatility.
- Operational advantages, such as easier short sales, lower transaction costs, greater leverage, and lower cash requirements.
- Improved market efficiency, by making it easier to exploit mispriced securities.

Risks of derivatives, compared to cash market transactions, include:

- Greater implicit leverage.
- Less transparency.
- **Basis risk** when the derivative does not perfectly match the risk being hedged.

- Liquidity risk, such as margin calls to maintain a futures hedge.
- Counterparty credit risk for derivatives that do not involve central clearing parties.
- Systemic risk to financial markets and institutions.

Issuer uses of derivatives include hedging balance sheet risk from changes in asset and liability values and hedging the risk of earnings volatility from changes in interest rates or securities prices. For example, a company with sales in foreign markets might use foreign currency derivatives to manage its exchange rate risk. **Hedge accounting** permits companies to recognize gains and losses on some derivative hedges at the same time as changes in the values of assets or liabilities being hedged. This includes three types of hedge:

1. **Cash flow hedge**, such as currency forwards used to hedge the domestic currency value of foreign currency revenues, or interest rate swaps used to convert a floating-rate liability to fixed rate.
2. **Fair value hedge**, for assets or liabilities the company recognizes at fair value. For example, if a company uses fair value accounting for a bond liability, using an interest rate swap to convert the liability to floating rate is a fair value hedge.
3. **Net investment hedge**, to decrease volatility in the balance sheet value of a foreign subsidiary in the parent's domestic currency.

Investor uses of derivatives, as we have seen, are to hedge, modify, or increase their exposure to the risk of an underlying asset or interest rate.

ARBITRAGE, REPLICATION, AND THE COST OF CARRY IN PRICING DERIVATIVES

Derivatives prices are based on a **no-arbitrage condition**. If we can create a portfolio with cash market transactions that has the same payoffs as a derivative for all possible future values of the underlying (we call this **replication**), the derivative must have the same value as that portfolio, or there will be an arbitrage opportunity that market participants will exploit rapidly.

We can replicate a long position in an asset that has no costs or benefits of holding it by buying a forward priced at $F_0(T)$ and buying a bond that pays the forward price, $F_0(T)$, at settlement. The proceeds of the bond will pay the forward price for the asset at settlement time = T, and we will own the asset with a value of S_T at time = T.

To prevent arbitrage, the asset price at t = 0, S_0, must equal the present value of the bond, $F_0(T) / (1 + Rf)^T$; that is:

$$S_0 = F_0(T) / (1 + Rf)^T$$

We can solve for the no-arbitrage price of the forward at t = 0 as:

$$F_0(T) = S_0(1 + Rf)^T$$

Costs and Benefits of Holding an Underlying Asset

Some underlying assets, such as physical commodities, involve costs such as storage and insurance to hold them. On the other hand, holding commodities may have nonmonetary benefits, such as the opportunity to sell them if their price is temporarily high (we refer to such benefits as **convenience yield**). Underlying assets such as financial securities may have cash benefits of holding them, such as interest or dividend payments.

The no-arbitrage forward price must account for any costs or benefits of holding the underlying. Denoting the present value of any costs of holding the asset from time 0 to settlement as PV_0(costs), and the present value of any benefits over the forward's life as PV_0(benefits), the no-arbitrage forward price is:

$$F_0(T) = [S_0 + PV_0(\text{costs}) - PV_0(\text{benefits})](1 + Rf)^T$$

Note the signs on the costs and benefits. Costs of holding an asset *increase* its no-arbitrage forward price, while benefits from holding an asset *decrease* its no-arbitrage forward price.

The **net cost of carry** (or **cost of carry**, or simply **carry**) is the benefits minus the costs, where costs include the risk-free return. For an underlying with a positive net cost of carry (benefits > costs including Rf), the forward price will be less than the spot price.

We can also describe the relationship between spot and forward prices using continuously compounded rates of return.

- With no costs or benefits of holding the underlying asset, the no-arbitrage price of a forward that settles at time T is: $F_0(T) = S_0e^{rT}$, where *r* is the stated annual risk-free rate with continuous compounding.
- With costs expressed as a continuously compounded annual rate of *c*, and benefits expressed as a continuously compounded annual rate of *b*, the no-arbitrage price of a forward that settles at time T is: $F_0(T) = S_0e^{(r + c - b)T}$.

PRICING AND VALUATION OF FORWARD CONTRACTS AND FOR AN UNDERLYING WITH VARYING MATURITIES

Restating the relationship we have just seen, we can say the *value at initiation* of a forward contract equals zero:

$$V_0(T) = S_0 - F_0(T)(1 + Rf)^{-T} = 0$$

Note that $F_0(T)(1 + Rf)^{-T} = F_0(T) / (1 + Rf)^T$, the present value of the forward contract price.

The value to the buyer of a forward contract *during its life* is the current spot price of the asset minus the present value of the forward contract price:

$$V_t(T) = S_t - F_0(T)(1 + Rf)^{-(T-t)}$$

Including the carrying costs and benefits, the value to the buyer of a forward contract during its life is:

$$V_t(T) = [S_t + PV_t(\text{costs}) - PV_t(\text{benefits})] - F_0(T)(1 + Rf)^{-(T-t)}$$

where PV_t(costs) and PV_t(benefits) are the values at time = t of the costs and benefits remaining.

The value to the buyer of a forward contract *at settlement* is the difference between the spot price at expiration and the forward price:

$$V_T(T) = S_T - F_0(T)$$

At all times, the value to the seller is the opposite of the value to the buyer. If the forward buyer has a gain, the forward seller has an equal loss, and vice versa.

Forward Rate Agreements

Recall from Fixed Income that forward rates are yields for future periods, and that we can determine implied forward rates from spot rates. A **forward rate agreement (FRA)** is a derivative contract that has an interest rate as its underlying. In an FRA, the fixed-rate payer will pay the forward rate on a notional amount of principal at a future date, and the floating-rate payer will pay a future reference rate times the notional principal. In practice, the parties only exchange the net amount owed.

Financial institutions use FRAs to manage the volatility of their interest-sensitive assets and liabilities. FRAs are also the building blocks of interest rate swaps over multiple periods. An FRA is equivalent to a single-period swap.

PRICING AND VALUATION OF FUTURES CONTRACTS

With a forward contract (assuming no mark-to-market), the price $F_0(T)$ remains the same throughout its life, while the contract's value to each party fluctuates with changes in the value of the underlying. With futures contracts, because of marking to market, the *price* changes and the *value* returns to zero daily.

Futures contracts are marked to market during their lives, while forward contracts typically are not. This can lead to differences between futures prices and forward prices for otherwise identical contracts. If the price of the underlying asset is positively correlated with interest rates, long futures positions will generate cash when rates are higher and require funds when rates are lower. This makes futures more desirable than forwards.

When futures prices are negatively correlated with interest rates, forwards will be more desirable than futures. The more desirable derivative will have a higher contract price. If rates are uncorrelated with futures prices, which includes the case where rates are constant, forwards and futures are equally desirable.

Interest Rate Futures and Forward Prices

Interest rate futures on market reference rates are quoted on a price basis. For a market reference rate from time A to time B, an interest rate futures price is stated as:

$$\text{Futures price} = 100 - (100 \times \text{MRR}_{\text{A, B–A}})$$

For example, if the futures price for a 6-month rate six months from now is 97, then $\text{MRR}_{\text{6m, 6m}} = 3\%$.

The **basis point value (BPV)** of an interest rate futures contract is defined as:

$$\text{BPV} = \text{notional principal} \times \text{period} \times 0.01\%$$

A one basis point change in either direction will change the futures contract value by its BPV. This contrasts with interest rate forward contracts, which exhibit **convexity bias** in that an increase in the reference rate decreases a forward's value by less than a decrease in the reference rate increases its value. Just as we see with bonds, the convexity effect increases for longer periods. As a result, forward and futures prices can be significantly different for contracts on longer-term interest rates. In practice, the convexity effect for forwards and futures on short-term interest rates is very small, and we don't observe differences in their prices.

PRICING AND VALUATION OF INTEREST RATES AND OTHER SWAPS

We can describe a fixed-for-floating interest rate swap as being equivalent to a series of forward rate agreements, each with a fixed rate equal to the **par swap rate**. These FRAs are not necessarily market FRAs that have initial values of zero. The *sum* of the values of the FRAs that comprise a swap will be equal to zero at the initiation of a swap, but individually these FRAs may have positive or negative values.

As with FRAs, the *price* of a swap is the fixed rate specified in the contract (the swap rate), and the *value* depends on how expected future short-term rates change over time. The value of a swap (to the fixed-rate payer) is the present value of the expected floating-rate payments minus the present value of the fixed-rate payments. An increase in expected future short-term rates will increase the value of the fixed-rate payer position in a swap, while a decrease in expected rates will decrease the value of the swap to the fixed-rate payer.

PRICING AND VALUATION OF OPTIONS

Options: Moneyness, Intrinsic Value, Time Value

An option that would provide a positive payoff if exercised is said to be **in the money**. The **intrinsic value** of an option is the amount that it is in the money or zero if the option is at- or out-of-the-money. The difference between the price of an option (called its premium) and its intrinsic value is termed its **time value**. Hence:

$$\text{option premium} = \text{intrinsic value} + \text{time value}$$

The following table summarizes the moneyness of options based on the stock's current price, *S*, and the option's exercise price, *X*.

Moneyness	Call Option	Put Option
In the money	S > X	S < X
At the money	S = X	S = X
Out of the money	S < X	S > X

Factors Determining European Option Values

Price of the Underlying Asset

An increase in the price of the underlying asset will increase the value of a call option, and a decrease in the price of the underlying asset will decrease the value of a call option.

An increase in the price of the underlying asset will decrease the value of a put option, and a decrease in the price of the underlying asset will increase the value of a put option.

The Exercise Price

A higher exercise price decreases the values of call options, and a lower exercise price increases the values of call options.

A higher exercise price increases the values of put options, and a lower exercise price decreases the values of put options.

The Risk-Free Rate of Interest

For options on assets other than bonds, an increase in the risk-free rate will increase call values, and a decrease in the risk-free rate will decrease call values.

An increase in the risk-free rate will decrease put option values, and a decrease in the risk-free rate will increase put option values.

Volatility of the Underlying

An increase in the volatility of the price of the underlying asset increases the values of both put and call options and a decrease in volatility of the price of the underlying decreases both put values and call values.

Time to Expiration

Longer time to expiration increases expected volatility of the asset price over the option's life and increases the value of call options. Less time to expiration decreases the value of call options.

For most put options, longer time to expiration will increase option values because expected volatility is greater with longer time to expiration. For some European put options, however, extending the time to expiration can decrease the value of the put because the intrinsic value will be paid in the future and its present value decreases with longer time to expiration.

In general, the deeper a put option is in the money, the higher the risk-free rate; the longer the current time to expiration, the more likely that extending a put option's time to expiration will decrease its value.

Costs and Benefits of Holding the Asset

If there are benefits of holding the underlying asset (dividend or interest payments on securities or a convenience yield on commodities), call values are decreased and put values are increased.

An increase in storage costs for an asset has the opposite effect: increasing call values and decreasing put values. Call values increase because owning a call option becomes relatively more attractive than holding the asset itself when storage costs increase. Put values fall because buying and holding the asset for future delivery at the put price becomes more expensive.

OPTION REPLICATION USING PUT–CALL PARITY

Put-Call Parity for European Options

Put-call parity is based on the no-arbitrage principle that portfolios with identical payoffs must sell for the same price. A **fiduciary call** (composed of a European call option and a risk-free bond that will pay *X* at expiration) and a **protective put** (composed of a share of stock and a long put) both have identical payoffs at maturity regardless of value of the underlying asset at expiration. Based on this fact and the law of one price, we can state that, for European options:

$$c + X / (1 + R_f)^T = S + p$$

That is, the value of a call at *X* and the present value of the exercise price must equal the current asset price plus the value of a put or there would be an opportunity for profitable arbitrage. Using just a bit of algebra, we can also state that:

$$S = c - p + X / (1 + R_f)^T$$

$$p = c - S + X / (1 + R_f)^T$$

$$c = S + p - X / (1 + R_f)^T$$

$$X / (1 + R_f)^T = S + p - c$$

The single securities on the left-hand side of the equations all have exactly the same payoffs at expiration as the portfolios on the right-hand side. The portfolios on the right-hand side are the "synthetic" equivalents of the securities on the left. Note that the options must be European-style, and the puts and calls must have the same exercise price, *X*, for these relations to hold.

If these equalities do not hold, buying the "cheap" side of the equation and selling the other "expensive" side will produce an immediate riskless arbitrage profit.

Put-Call Forward Parity for European Options

Put-call forward parity is derived with a forward contract rather than the underlying asset itself. A forward contract on an asset at time *T* has zero value at initiation; therefore, a long forward at a price of $F_0(T)$, combined with a bond that pays the forward price, $F_0(T)$, at the settlement date is equivalent to owning the asset at settlement. The cost of this position is simply the present value of $F_0(T)$, or $F_0(T) / (1 + R_f)^T$. Because this is a way to own the asset at expiration, we can substitute this value for the current price of the asset in put-call parity for European options and get:

$$F_0(T) / (1 + R_f)^T + p_0 = c_0 + X / (1 + R_f)^T$$

which is put-call forward parity at time 0, the initiation of the forward contract, based on the principle of no arbitrage. By rearranging the terms, put-call forward parity can also be expressed as:

$$p_0 - c_0 = [X - F_0(T)] / (1 + R_f)^T$$

VALUING A DERIVATIVE USING A ONE-PERIOD BINOMIAL MODEL

In a **one-period binomial model**, the price of the underlying will change to one of two possible values at the end of the period—either an up-move (increase in price) or a down-move (decrease in price).

For our first model we need the following inputs:

- The risk-free rate.
- A value for the underlying at the beginning of the period.
- An exercise price for an option that expires one period from now.
- Returns that will result from an up-move and a down-move in the underlying value.

In such a model, we can find a combination (portfolio) of an option and some fraction of the underlying that will have the same value at the end of the period after either an up-move or a down-move in the underlying. The fraction of the underlying in such a portfolio is referred to as the **hedge ratio** (shares per derivative unit). Because the value of the portfolio is certain at the end of the period, regardless of the change in asset price, we discount this end-of-period value by the risk-free rate to get its present value. Using the current value of the underlying asset and the portfolio value, we can solve for the current value of the option.

An alternative approach is to first calculate the value of the payoff on the option at the end of the period using the **risk-neutral probabilities** (not actual probabilities) of an up-move and a down-move in the price of the underlying. Note that the probability of a down-move (π_D) = 1 – probability of an up-move (π_U) in either case.

The risk-neutral probability of an up-move is calculated as:

$$\pi_U \frac{1 + R_f - D}{U - D}$$

where U = up-move price/current price and D = down-move price/current price for the underlying asset (1 + the percentage return in each case).

The (risk-neutral) expected payoff on the option is:

$$\pi_U \times \text{up-move option value} + \pi_D \times \text{down-move option value}$$

Because we used risk-neutral probabilities, we can discount the expected option payoff at the risk-free rate to get the current value of the option. This method is equivalent to the hedge portfolio valuation method described above and will produce the same option value.

ALTERNATIVE INVESTMENTS

Weight on Exam	5% to 8%
SchweserNotes™ Reference	Book 4, Pages 223–257

CATEGORIES, CHARACTERISTICS, AND COMPENSATION STRUCTURES OF ALTERNATIVE INVESTMENTS

Alternative investments differ from traditional investments in the types of assets and securities included in this asset class and in the structure of the investment vehicles in which these assets are held. Managers of alternative investment portfolios may use derivatives, leverage, and short positions in securities. Many types of real estate investments are considered alternative investments as well. (For the exam, alternative investments are what the CFA curriculum says they are.)

Compared to traditional investments, alternative investments typically exhibit several of the following characteristics:

- Less-liquid assets.
- More specialization by investment managers.
- Less regulation and transparency.
- More problematic and less available return and volatility data.
- Different legal issues and tax treatments.
- Relatively low correlations with returns of traditional investments.
- Higher fees.
- Restrictions on redemptions.
- More-concentrated portfolios.

Types of alternative investment structures include hedge funds, private capital funds, real estate, natural resources, and infrastructure.

- **Hedge funds** may use leverage, hold long and short positions, use derivatives, and invest in illiquid assets. Managers of hedge funds use many different strategies in attempting to generate investment gains. They do not necessarily hedge risk.
- **Private capital** includes private equity and private debt. Private equity funds invest in the equity of companies that are not publicly traded, or in the equity of publicly traded companies that the funds intend to take private. Two types are leveraged buyout funds and venture capital funds. Private debt funds may make loans directly to companies, lend to venture firms, or invest in the debt of financially distressed firms.
- **Real estate** investments include residential or commercial properties, as well as real estate–backed debt.

- **Natural resources** include commodities, farmland, and timberland. To gain exposure to changes in commodity prices, investors can own physical commodities, commodity derivatives, or the equity of commodity-producing firms. Farmland can produce income from leasing it out for farming or from raising crops or livestock for harvest and sale. Timberland is purchased or trees are planted for harvesting, which provides cash flows.
- **Infrastructure** refers to long-lived assets that provide public services. These include economic infrastructure assets, such as roads, airports, and utility grids, and social infrastructure assets, such as schools and hospitals.

Investment Methods

Direct investing refers to an investor that purchases assets itself, rather than pooling its funds with others or using a specialized outside manager. Advantages of direct investing are that there are no fees to outside managers and the investor has more choice and control over the investments made. Disadvantages include the possibility of less diversification across investments, high minimum investment amounts, and the level of investor expertise required.

Fund investing refers to investing in a pool of assets along with other investors using a fund manager that selects and manages the pool of investments according to an agreed-upon strategy. The manager typically receives a percentage of the investable funds as a management fee, as well as a percentage of the investment gains as an incentive fee. Compared to direct investing, the advantages of investing through a fund include the expertise of the fund manager, less involvement and expertise required of the investor, diversification across investments made by the fund, and lower minimum investment requirements. Disadvantages are the cost of fund manager fees and the possibility that the manager may perform poorly.

With **co-investing**, an investor contributes to a pool of investment funds but also invests directly alongside the fund manager in the assets in which the manager invests. Co-investing can reduce overall fees while the investor benefits from the manager's expertise.

Investment and Compensation Structures

Alternative investments are often structured as **limited partnerships** in which the **general partner (GP)** is the fund manager and makes investment decisions. The **limited partners (LPs)** are the investors, who own a partnership share proportional to their investment. LPs commit to an investment amount and in some cases only contribute a portion of that initially. Limited partnership shares are typically only available to accredited investors. The rules that govern a partnership are contained in its limited partnership agreement, while special terms that apply to one LP but not to others may be stated in **side letters**.

Management fees are typically between 1% and 2% and are paid regardless of performance. Hedge fund management fees are calculated as a percentage of assets under management (AUM). For private capital funds, the management fee is calculated as a percentage of **committed capital**, not capital invested (committed capital is typically drawn down over time rather than all being invested immediately). Committed capital that has not yet been drawn down is referred to as **dry powder**.

Incentive fees are a portion of profits on fund investments. Most partnership agreements specify a rate of return that must be met or exceeded before any incentive fees are paid. If a **soft hurdle rate** is met, incentive fees are a percentage of the total increase in the value of each partner's investment. With a **hard hurdle rate**, incentive fees are based only on gains above the hurdle rate. Typically, incentive fees are paid at the end of each year based on the increase in the value of fund investments after management fees.

A **catch-up clause** is similar in its effect to a soft hurdle rate. Consider a fund with returns of 14%, a hurdle rate of 8%, and a 20% incentive fee. A catch-up clause would result in the first 8% of gains going to the LPs and the next 2% going to the GP, allowing the GP to catch up to receiving 20% of the first 10% of gains. After the catch-up, further gains are split 80/20 between the LPs and the GP.

A **high-water mark** means that incentive fees are only paid to the extent that the current value of an investor's account is above the highest net-of-fees value previously recorded. This ensures that investors will not be charged incentive fees twice on the same gains in their portfolio values. Because LPs may invest in a fund at different times, they each may have a different high-water mark.

A partnership's **waterfall** refers to the way in which profits are allocated to the GP and the LPs. With a **deal-by-deal waterfall** (or **American waterfall**), profits are distributed as they are realized on each individual fund investment. This favors the GP because incentive fees are paid before the LPs' original investment in the entire fund plus the hurdle rate has been distributed to them. With a **whole-of-fund waterfall** (or **European waterfall**), the LPs receive all distributions until they have received their initial investment in the fund plus the hurdle rate.

With a deal-by-deal waterfall, it may be that successful deals are exited initially and losses are realized later. A **clawback provision** would allow the LPs to recover incentive fees paid to the GP to the extent that they exceed the incentive fees due based on the cumulative profits for the entire fund.

Before-fee returns on alternative investments are calculated the same way we calculate returns on any investment. Calculating after-fee returns simply requires adjusting the cash flows for the fees.

Although "2 and 20" (2% management fee and 20% incentive fee) was at one time a standard fee structure for fund investments, fee structures have been under competitive pressure. Investors making larger commitments can negotiate lower fees. There can also be a trade-off between liquidity provisions and fees. Investors can negotiate for lower fees or better liquidity (shorter lockups and notice periods). Hurdle rates, hard versus soft hurdles, and catch-up provisions may also be subject to negotiation.

Annual investor fees can also be **either-or fees**—the maximum of the management fee or the incentive fee. Under such a structure, with a 1% management fee and a 30% incentive fee, investor fees each year would be simply the management fee unless the calculated incentive fee is greater.

Early investors in a fund may receive lower fees or better liquidity terms as an incentive to invest at inception. The investment interests of these early investors are called **founder's shares**.

PERFORMANCE CALCULATION AND APPRAISAL OF ALTERNATIVE INVESTMENTS

A commonly reported risk-adjusted return measure for alternative investments is the **Sharpe ratio**, which is excess return per unit of risk. The biggest issue with using this statistic is that standard deviation may not be the appropriate measure of risk. Some analysts prefer the **Sortino ratio**, which uses downside deviation.

One limitation of both the Sharpe and Sortino ratios is that they do not take into account the diversification benefits from low correlations with returns to traditional investments. The **Treynor ratio** uses beta, a measure of systematic risk that is based on return correlations, as the denominator. Another measure is the **Calmar ratio**, which is the average annual compound return divided by the maximum drawdown (decrease in value from peak to trough). For all these ratios, larger values are preferred, as we are measuring returns relative to risk.

Private capital and real estate investments are often characterized by cash inflows and outflows over an investment's life. One simple measure of investment success is the **multiple of invested capital**, or **money multiple**, which is the ratio of total capital returned plus the value of any remaining assets to the total capital paid in over the life of the investment. Because this measure does not consider the timing of cash inflows and outflows, internal rates of return are often used as performance measures for private equity and real estate. Given the variability of cash flows over a fund's life and the importance of management decisions in the timing and magnitude of after-tax cash flows, an IRR over the life of a fund is the most appropriate measure of after-tax investment performance.

For funds where initial committed capital is drawn down over time, if returns are calculated on committed capital, there is a fee drag on calculated returns. This results in a pattern of low returns early in the fund's life and higher returns later in its life.

PRIVATE CAPITAL, REAL ESTATE, INFRASTRUCTURE, NATURAL RESOURCES, AND HEDGE FUNDS

Private Equity

The companies in which a private equity fund invests are known as its **portfolio companies**. A private equity fund may charge fees for arranging buyouts, for a deal that does not happen, or for handling asset divestitures after a buyout.

Leveraged buyouts (LBOs) are the most common type of private equity fund investment. Two types of LBOs are **management buyouts (MBOs)**, in which the existing management team is involved in the purchase, and **management buy-ins (MBIs)**, in which an external management team will replace the existing management team. Firms with high cash flow are attractive LBO candidates because their cash flow can be used to service and eventually pay down the debt taken on for acquisition.

Developmental capital, or **minority equity investing**, refers to the provision of capital for business growth or restructuring. The firms financed may be public or private. In the case

of public companies, such financing is called **private investment in public equities (PIPEs)**.

Venture capital funds invest in companies in the early stages of their development. While the risk of start-up companies is often great, returns on successful companies can be very high. Venture capital fund managers are actively involved in the development of their portfolio companies. Stages of a venture company's life include the following:

1. **Formative stage.** A firm's earliest period can be divided into three phases:
   – **Angel investing** or **pre-seed capital.** The company uses investment funds for business plans and assessing market potential.
   – **Seed stage** or **seed capital.** This is typically when venture capital funds make their initial investments, which are used for product development, marketing, and market research.
   – **Early stage** or **start-up stage.** Investments fund the company's initial commercial production and sales.
2. **Later-stage investment** or **expansion venture capital.** Funds provided at this stage are typically used to expand production or increase sales.
3. **Mezzanine-stage financing.** The company prepares for an IPO.

The average holding period for portfolio companies is five years. Methods of exiting an investment in a portfolio company include the following:

- **Trade sale.** Sell to a competitor or other strategic buyer.
- **IPO.** Sell all or some shares to the public.
- **Recapitalization.** The company issues debt to fund a dividend distribution to the fund. This is not an exit but is often a step toward an exit.
- **Secondary sale.** Sell to another private equity firm or group of investors.
- **Write-off/liquidation.** Take losses from an unsuccessful outcome.

Less-than-perfect correlation of private equity returns with traditional investment returns suggests diversification benefits from including private equity in portfolios. The standard deviation of private equity returns has been higher than the standard deviation of equity index returns, suggesting greater risk. Because portfolio companies are revalued infrequently, reported standard deviations and correlations with equity returns may both be biased downward. As with hedge fund returns data, private equity returns data may suffer from survivorship bias and backfill bias.

Private Debt

Private debt refers to lending to private entities. The terms used include the following:

- **Direct lending.** Loans made directly to a private entity. A **leveraged loan** refers to a loan made by a private debt fund using money borrowed from another source.
- **Venture debt.** Lending to venture firms. Venture debt is often convertible to the venture firm's common stock or combined with warrants.
- **Mezzanine loans.** Private debt that is subordinated. It may have special features such as conversion rights or warrants.

- **Distressed debt.** Purchasing the debt of firms in bankruptcy, in default on existing loans, or for which default seems imminent.

Private debt firms may also invest in a wide variety of other types of debt. Some private capital firms invest in both the debt and equity of their portfolio companies.

Commodities

The most commonly used instruments to gain exposure to commodity prices are derivatives. Futures, forwards, options, and swaps are all available forms of commodity derivatives. Other methods of gaining exposure to commodities returns include exchange-traded funds, equities that are linked to a commodity, managed futures funds, and commodity funds in specific sectors.

Returns on commodities over time have been less than returns on global stocks or bonds. Correlations of commodity returns with those of global equities and global bonds have been low, so adding commodities to a traditional portfolio has provided diversification benefits. Because commodity prices tend to move with inflation rates, holding commodities can hedge inflation risk.

For many commodities, supply is inelastic in the short run because of long lead times to alter production levels. As a result, commodity prices can be volatile when demand changes significantly over the economic cycle. To forecast commodity prices, investors analyze inventory levels, forecasts of production, changes in government policy, and expectations of economic growth.

A commodity today and a commodity in the future are different products. Purchasing a commodity today gives the buyer use of it if needed, while contracting for it to be delivered six months from today avoids storage costs and interest costs on invested cash. The following is an equation that considers these aspects:

> $$\text{futures price} \approx \text{spot price}\,(1 + \text{risk-free rate}) + \text{storage costs} - \text{convenience yield}$$

Convenience yield is the value of having the physical commodity for use over the period of the futures contract. If there is little or no convenience yield, futures prices will be higher than spot prices, a situation termed **contango**. When the convenience yield is high, futures prices will be less than spot prices, a situation referred to as **backwardation**.

Farmland and Timberland

Returns from farmland and timberland come from sales of timber or agricultural products and from price changes on the land, which depend on expected prices of lumber and farm commodity prices. While most agricultural crops must be harvested within a short period, timber is different in that the choice of when to harvest is based on current prices and expected growth rates.

Because agricultural crops (including trees) consume carbon, farmland and timberland are attractive to investors with an ESG focus on climate change. Risks include low liquidity, high fixed costs of production, variable cash flows that depend on weather, and potential losses from natural disasters.

Real Estate

Real estate as an asset class can provide diversification benefits to an investor's portfolio and a potential inflation hedge because rents and real estate values tend to increase with inflation. Assets included under the heading of real estate investments include residential property, commercial property, and loans with residential or commercial property as collateral.

Residential property is considered a direct investment in real estate. Most buyers take on a mortgage to purchase. The mortgage lender has a direct investment in a whole loan and is said to hold the mortgage. Mortgages are often pooled into mortgage-backed securities (MBS), which represent an indirect investment in the mortgage loan pool.

Commercial real estate properties generate income from rents. Homes purchased for rental income are considered investments in commercial property. Long time horizons, illiquidity, the large size of investments needed, and the complexity of the investments make commercial real estate inappropriate for many investors. As with residential mortgages, commercial property mortgages can be pooled into commercial mortgage-backed securities.

Real estate investment trusts (REITs) issue shares that trade publicly like shares of stock. REITs are often identified by the type of real estate assets they hold: mortgages, hotel properties, malls, office buildings, or other commercial property. Typically, 90% of income must be distributed to shareholders to avoid taxes on this income, which would have to be paid by the REIT.

Real estate performance is measured by three different types of indexes:

1. An **appraisal index** is based on periodic estimates of property values. Appraisal index returns are smoother than those based on actual sales and have the lowest standard deviation of returns of the index methods.
2. A **repeat sales index** is based on price changes for properties that have sold multiple times, a sample that is not necessarily representative of all properties available.
3. A **REIT index** is based on the actual trading prices of REIT shares, similar to equity indexes.

Property values fluctuate because of global and national economic factors, local market conditions, and interest rate levels. The degree of leverage used in a real estate investment is important because leverage amplifies losses as well as gains.

Distressed-property investing has additional risk factors compared with investing in properties with sound financials and stable operating histories. Real estate development has additional risk factors, including regulatory issues.

Infrastructure

Infrastructure investments include transportation assets, such as roads, airports, ports, and railways, as well as utility assets, such as gas distribution facilities, electric generation and distribution facilities, and waste disposal and treatment facilities. Other categories of infrastructure investments are communications (e.g., broadcast assets and cable systems) and social (e.g., prisons, schools, and health care facilities).

Investments in infrastructure assets that are already constructed are referred to as **brownfield investments**. In general, investing in brownfield investments provides stable cash flows and relatively high yields but offers little potential for growth.

Investments in infrastructure assets that are to be constructed are referred to as **greenfield investments**. Investing in greenfield investments is subject to more uncertainty and may provide relatively lower yields but offers greater growth potential.

Infrastructure assets typically have long lives and are quite large in cost and scale, so direct investments in them are not liquid. ETFs, mutual funds, private equity funds, or master limited partnerships that invest in infrastructure assets can provide greater liquidity.

Hedge Funds

Hedge funds generally use leverage, take both long and short positions, and use derivatives for speculation or hedging portfolio risk.

Hedge funds typically have restrictions on LP redemptions. A **lockup period** is the time after initial investment over which LPs either cannot request redemptions or incur significant fees for redemptions (a **soft lockup**). A **notice period** is the amount of time a fund has to fulfill a redemption request made after the lockup period has passed. Redemptions often increase when hedge fund performance is poor over a period, and the costs of honoring redemptions may further decrease the value of the remaining partnership interests.

According to Hedge Fund Research, Inc., there are four main classifications of hedge fund strategies:

- **Event-driven strategies** are typically based on a corporate restructuring or acquisition that creates profit opportunities for long or short positions in common equity, preferred equity, or debt of a specific corporation. Subcategories are merger arbitrage, distressed/restructuring, activist shareholder, and special situations.
- **Relative value strategies** involve buying a security and selling short a related security with the goal of profiting when a perceived pricing discrepancy between the two is resolved. Subcategories include convertible arbitrage fixed income, asset-backed fixed income, general fixed income, volatility, and multi-strategy.
- **Macro strategies** are based on global economic trends and events and may involve long or short positions in equities, fixed income, currencies, or commodities.
- **Equity hedge fund strategies** seek to profit from long or short positions in publicly traded equities and derivatives with equities as their underlying assets. Subcategories include market neutral, fundamental growth, fundamental value, quantitative directional, and short bias.

A **fund-of-funds** is an investment company that invests in hedge funds. Fund-of-funds investing can give investors diversification among hedge fund strategies, provide expertise in selecting hedge funds, and provide smaller investors with access to hedge funds. Fund-of-funds managers charge an additional layer of fees beyond the fees charged by the individual hedge funds in the portfolio. These fees to the fund-of-funds manager can reduce investor net returns significantly.

Hedge fund returns have tended to be better than those of global equities in down equity markets and to lag the returns of global equities in up markets. Different hedge fund strategies have had the best returns at different times. Less-than-perfect correlation with global equity returns may offer some diversification benefits, but correlations tend to increase during periods of financial crisis.

Hedge fund index returns may exhibit **survivorship bias** because funds that have stayed in business for multiple years (i.e., have been successful) or reached a specific level of assets under management tend to be over-represented. They may also exhibit **backfill bias** when a fund's returns for prior years are factored into historical index returns when the fund is added to the index.

Model values and appraisal values are typically less volatile than market values. To the extent that funds use models or appraisals for asset valuation and return calculations, both standard deviations of fund returns and correlations of fund returns with those of traditional investments will be biased downward.

PORTFOLIO MANAGEMENT

Weight on Exam	5% to 8%
SchweserNotes™ Reference	Book 5, Pages 1–135

PORTFOLIO MANAGEMENT: AN OVERVIEW

The Portfolio Perspective

The **portfolio perspective** refers to evaluating individual investments by their contribution to the risk and return of an investor's overall portfolio. The alternative is to examine the risk and return of each security in isolation. An investor who holds all his wealth in a single stock because he believes it to be the best stock available is not taking the portfolio perspective—his portfolio is very risky compared to a diversified portfolio.

Modern portfolio theory concludes that the extra risk from holding only a single security is not rewarded with higher expected investment returns. Conversely, diversification allows an investor to reduce portfolio risk without necessarily reducing the portfolio's expected return.

The **diversification ratio** is calculated as the ratio of the risk of an equal-weighted portfolio of *n* securities (standard deviation of returns) to the risk of a single security selected at random from the portfolio. If the average standard deviation of returns of the *n* stocks is 25%, and the standard deviation of returns of an equal-weighted portfolio of the *n* stocks is 18%, the diversification ratio is 18 / 25 = 0.72. Note that a *lower* diversification ratio indicates a *greater* risk-reduction benefit from diversification.

- Portfolio diversification works best when financial markets are operating normally.
- Diversification provides less reduction of risk during market turmoil.
- During periods of financial crisis, correlations tend to increase, which reduces the benefits of diversification.

Steps in the Portfolio Management Process

Planning begins with an analysis of the investor's risk tolerance, return objectives, time horizon, tax exposure, liquidity needs, income needs, and any unique circumstances or investor preferences.

This analysis results in an **investment policy statement (IPS)** that:

- Details the investor's investment objectives and constraints.
- Specifies an objective benchmark (such as an index return).
- Should be updated at least every few years and anytime the investor's objectives or constraints change significantly.

The **execution** step requires an analysis of the risk and return characteristics of various asset classes to determine the asset allocation. In *top-down* analysis, a portfolio manager

examines current macroeconomic conditions to identify the asset classes that are most attractive. In *bottom-up* analysis, portfolio managers seek to identify individual securities that are undervalued.

Feedback is the final step. Over time, investor circumstances will change, risk and return characteristics of asset classes will change, and the actual weights of the assets in the portfolio will change with asset prices. The portfolio manager must monitor changes, **rebalance** the portfolio periodically, and evaluate performance relative to the benchmark portfolio identified in the IPS.

Investment Management Clients

Individual investors save and invest for a variety of reasons, including purchasing a house or educating their children. In many countries, special accounts allow citizens to invest for retirement and to defer any taxes on investment income and gains until the funds are withdrawn. Defined contribution pension plans are popular vehicles for these investments.

Many types of **institutions** have large investment portfolios. **Defined benefit pension plans** are funded by company contributions and have an obligation to provide specific benefits to retirees, such as a lifetime income based on employee earnings.

An **endowment** is a fund that is dedicated to providing financial support on an ongoing basis for a specific purpose. A **foundation** is a fund established for charitable purposes to support specific types of activities or to fund research related to a particular disease.

The investment objective of a **bank** is to earn more on the bank's loans and investments than the bank pays for deposits of various types. Banks seek to keep risk low and need adequate liquidity to meet investor withdrawals as they occur.

Insurance companies invest customer premiums with the objective of funding customer claims as they occur.

Investment companies manage the pooled funds of many investors. **Mutual funds** manage these pooled funds in particular styles (e.g., index investing, growth investing, bond investing) and restrict their investments to particular subcategories of investments (e.g., large-firm stocks, energy stocks, speculative bonds) or particular regions (emerging market stocks, international bonds, Asian-firm stocks).

Sovereign wealth funds refer to pools of assets owned by a government.

Figure 1 provides a summary of the risk tolerance, investment horizon, liquidity needs, and income objectives for these different types of investors.

Figure 1: Characteristics of Different Types of Investors

Investor	Risk Tolerance	Investment Horizon	Liquidity Needs	Income Needs
Individuals	Depends on individual	Depends on individual	Depends on individual	Depends on individual
DB pensions	High	Long	Low	Depends on age
Banks	Low	Short	High	Pay interest
Endowments	High	Long	Low	Spending level
Insurance	Low	Long—life Short—P&C	High	Low
Mutual funds	Depends on fund	Depends on fund	High	Depends on fund

The Asset Management Industry

The asset management industry comprises firms that manage investments for clients. They are referred to as **buy-side firms**, in contrast with **sell-side firms** such as broker/dealers and investment banks.

Full-service asset managers are those that offer a variety of investment styles and asset classes.

Specialist asset managers may focus on a particular investment style or a particular asset class.

A **multi-boutique firm** is a holding company that includes a number of different specialist asset managers.

A key distinction is between firms that use active or passive management. **Active management** attempts to outperform a chosen benchmark through manager skill, for example by using fundamental or technical analysis. **Passive management** attempts to replicate the performance of a chosen benchmark index. This may include traditional broad market index tracking or a **smart beta** approach that focuses on exposure to a particular market risk factor.

Asset management firms may also be classified as traditional or alternative asset managers. Traditional asset managers focus on equities and fixed income securities. Alternative asset managers focus on asset classes such as private equity, hedge funds, real estate, or commodities.

Robo-advisors are a technology that offers investors portfolio allocation advice and recommendations based on their investment requirements and constraints, using a computer algorithm.

PORTFOLIO RISK AND RETURN: PART I

Risk and Return of Major Asset Classes

Based on U.S. data over the period 1926–2017, Figure 2 indicates that small capitalization stocks have had the greatest average returns and greatest risk over the period. T-bills had the lowest average returns and the lowest standard deviation of returns.

Figure 2: Risk and Return of Major Asset Classes in the United States (1926–2017)[1]

Assets Class	Average Annual Return (Geometric Mean)	Standard Deviation (Annualized Monthly)
Small-cap stocks	12.1%	31.7%
Large-cap stocks	10.2%	19.8%
Long-term corporate bonds	6.1%	8.3%
Long-term government bonds	5.5%	9.9%
Treasury bills	3.4%	3.1%
Inflation	2.9%	4.0%

Results for other markets around the world are similar: asset classes with the greatest average returns also have the highest standard deviations of returns.

Variance and Standard Deviation

Variance of the rate of return for a risky asset calculated from expectational data (a probability model) is the probability-weighted sum of the squared differences between the returns in each state and the unconditional expected return.

$$\text{variance} = \sigma^2 = \sum_{i=1}^{n} \{[R_i - E(R)]^2 \times P_i\}$$

$$\text{standard deviation} = \sigma = \sqrt{\sigma^2}$$

Covariance and Correlation

Covariance measures the extent to which two variables move together over time. The covariance of returns is an absolute measure of movement and is measured in return units squared.

Using *historical data*, we take the product of the two securities' deviations from their expected returns for each period, sum them, and divide by the number of (paired) observations minus one.

$$\text{cov}_{1,2} = \frac{\sum_{t=1}^{n} \left\{ [R_{t,1} - \bar{R}_1] \, [R_{t,2} - \bar{R}_2] \right\}}{n - 1}$$

Covariance can be standardized by dividing by the product of the standard deviations of the two securities. This standardized measure of co-movement is called their *correlation coefficient* or *correlation* and is computed as:

$$\text{correlation of assets 1 and 2} = \rho_{1,2} = \frac{\text{cov}_{1,2}}{\sigma_1 \sigma_2} \text{ so that,}$$
$$\text{cov}_{1,2} = \rho_{1,2} \sigma_1 \sigma_2$$

Risk Aversion

A **risk-averse** investor is simply one that dislikes risk (i.e., prefers less risk to more risk). Given two investments that have equal expected returns, a risk-averse investor will choose the one with less risk (standard deviation, σ).

A **risk-seeking** (risk-loving) investor actually prefers more risk to less and, given equal expected returns, will choose the more risky investment. A **risk-neutral** investor has no preference regarding risk and would be indifferent between two such investments.

A risk-averse investor may select a very risky portfolio despite being risk averse; a risk-averse investor may hold very risky assets if he feels that the extra return he expects to earn is adequate compensation for the additional risk.

Risk and Return for a Portfolio of Risky Assets

When risky assets are combined into a portfolio, the expected portfolio return is a weighted average of the assets' expected returns, where the weights are the percentages of the total portfolio value invested in each asset.

The standard deviation of returns for a portfolio of risky assets depends on the standard deviations of each asset's return (σ), the proportion of the portfolio in each asset (w), and, crucially, on the covariance (or correlation) of returns between each asset pair in the portfolio.

Portfolio standard deviation for a two-asset portfolio:

$$\sigma_p = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 w_1 w_2 \sigma_1 \sigma_2 \rho_{12}}$$
$$\text{which is equivalent to:}$$
$$\sigma_p = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 w_1 w_2 \text{Cov}_{12}}$$

If two risky asset returns are perfectly positively correlated, $\rho_{12} = +1$, then the square root of portfolio variance (the portfolio standard deviation of returns) is equal to:

$$\sigma_{\text{portfolio}} = \sqrt{\text{Var}_{\text{portfolio}}} = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 w_1 w_2 \sigma_1 \sigma_2 (1)}$$
$$= w_1 \sigma_1 + w_2 \sigma_2$$

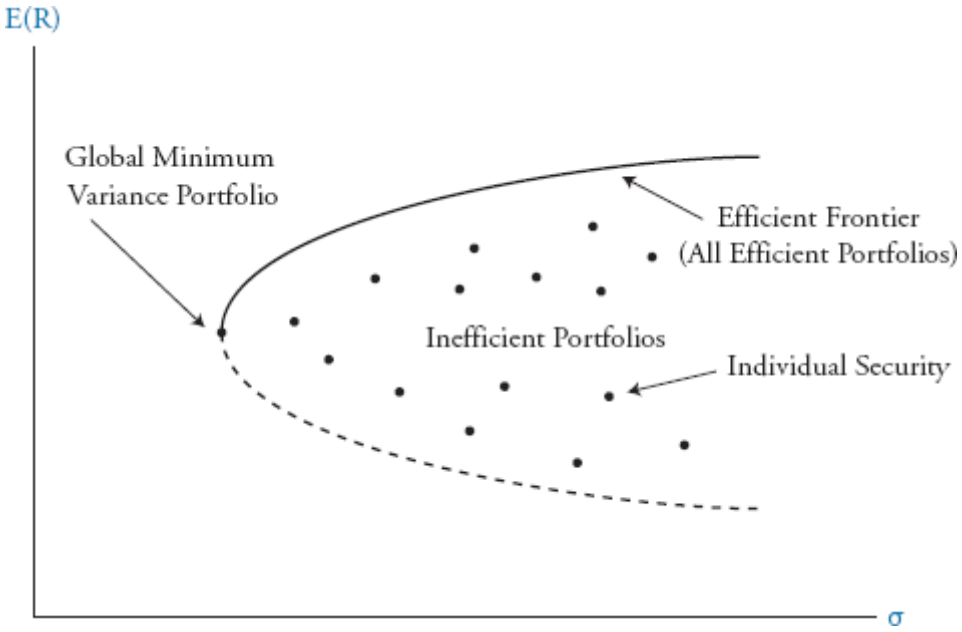
In this unique case, with $\rho_{12} = +1$, the portfolio standard deviation is simply the weighted average of the standard deviations of the individual asset returns.

Other things equal, the greatest portfolio risk results when the correlation between asset returns is +1. For any value of correlation less than +1, portfolio variance is reduced. Note that for a correlation of zero, the entire third term in the portfolio variance equation is zero. For negative values of correlation ρ_{12}, the third term becomes negative and further reduces portfolio variance and standard deviation.

Efficient Frontier

The Markowitz efficient frontier represents the set of possible portfolios that have the greatest expected return for each level of risk (standard deviation of returns).

Figure 3: Minimum Variance and Efficient Frontiers



An Investor's Optimal Portfolio

An investor's **expected utility function** depends on his degree of risk aversion. An **indifference curve** plots combinations of risk (standard deviation) and expected return among which an investor is indifferent, as they all have equal expected utility.

Indifference curves slope upward for risk-averse investors because they will only take on more risk if they are compensated with greater expected return. An investor who is relatively more risk averse requires a relatively greater increase in expected return to compensate for taking on greater risk. In other words, a more risk-averse investor will have steeper indifference curves.

In our previous illustration of efficient portfolios available in the market, we included only risky assets. When we add a risk-free asset to the universe of available assets, the efficient frontier is a straight line. Using the formulas:

$$E(R_{portfolio}) = W_A E(R_A) + W_B E(R_B)$$

$$\sigma_{portfolio} = \sqrt{W_A^2\sigma_A^2 + W_B^2\sigma_B^2 + 2W_A W_B \rho_{AB}\sigma_A\sigma_B}$$

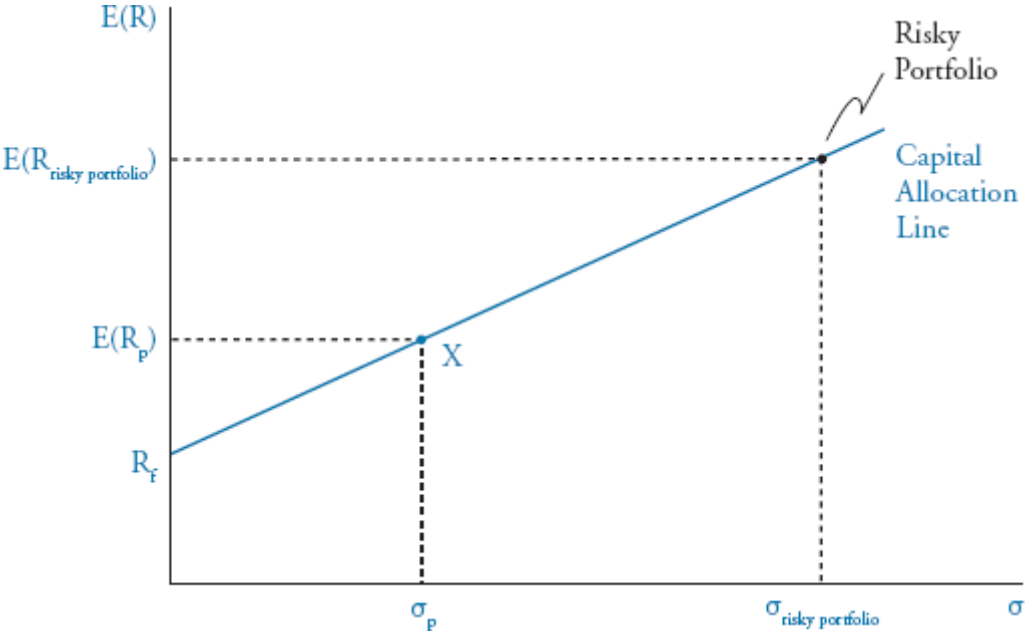
allow Asset B to be the risk-free asset and Asset A to be a risky portfolio of assets.

Because a risk-free asset has zero standard deviation and zero correlation of returns with those of the risky portfolio, this results in the reduced equation:

$$\sigma_{portfolio} = \sqrt{W_A^2 \sigma_A^2} = W_A \sigma_A$$

If we put X% of our portfolio into the risky asset portfolio, the resulting portfolio will have standard deviation of returns equal to X% of the standard deviation of the risky asset portfolio. The relationship between portfolio risk and return for various portfolio allocations is linear, as illustrated in Figure 4.

Figure 4: Capital Allocation Line and Risky Asset Weights

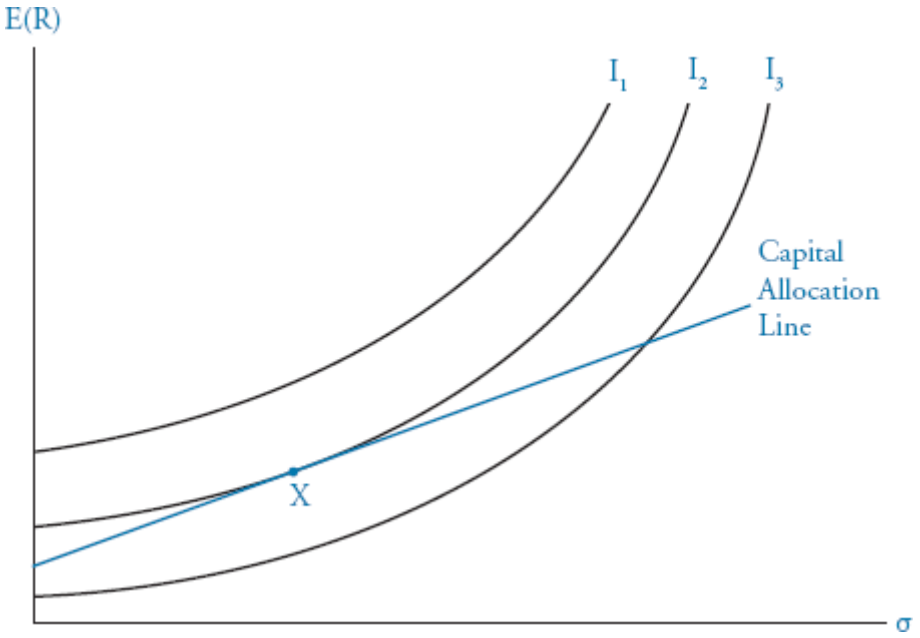


Combining a risky portfolio with a risk-free asset is the process that supports the **two-fund separation theorem**, which states that all investors' optimum portfolios will be made up of some combination of an optimal portfolio of risky assets and the risk-free asset. The line representing these possible combinations of risk-free assets and the optimal risky asset portfolio is referred to as the **capital allocation line**.

Point X on the capital allocation line in Figure 5 represents a portfolio that is 40% invested in the risky asset portfolio and 60% invested in the risk-free asset. Its expected return will be $0.40[E(R_{risky\ asset\ portfolio})] + 0.60(R_f)$ and its standard deviation will be $0.40(\sigma_{risky\ asset\ portfolio})$.

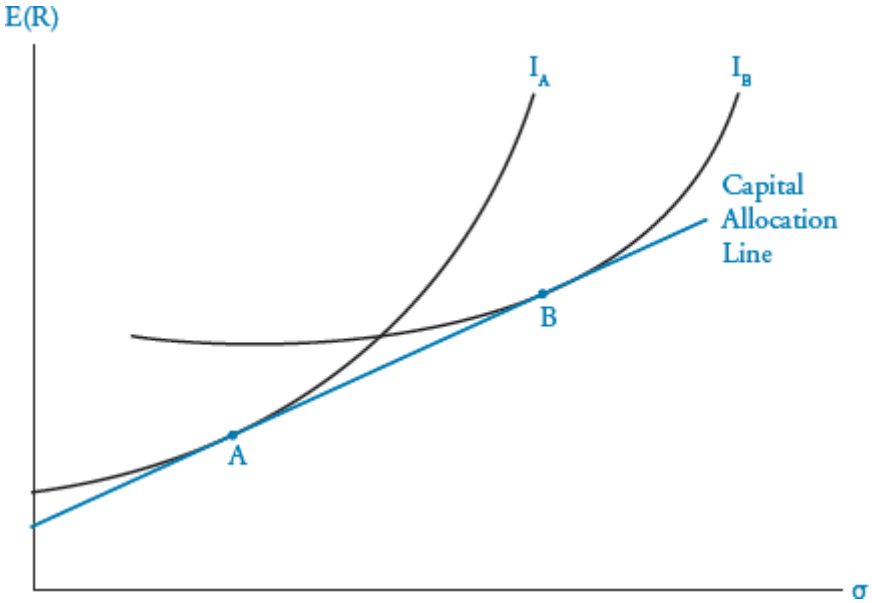
We can combine the capital allocation line with indifference curves to illustrate the logic of selecting an optimal portfolio (i.e., one that maximizes the investor's expected utility). In Figure 5, we can see that an investor with preferences represented by indifference curves I_1, I_2, and I_3 can reach the level of expected utility on I_2 by selecting portfolio X. This is the optimal portfolio for this investor, as any portfolio that lies on I_2 is preferred to all portfolios that lie on I_3 (and in fact to any portfolios that lie between I_2 and I_3). Portfolios on I_1 are preferred to those on I_2, but none of the portfolios that lie on I_1 are available in the market.

Figure 5: Risk-Averse Investor's Indifference Curves



The final result of our analysis here is not surprising; investors who are less risk averse will select portfolios with more risk. As illustrated in Figure 6, the flatter indifference curve for Investor B (I_B) results in an optimal (tangency) portfolio that lies to the right of the one that results from a steeper indifference curve, such as that for Investor A (I_A). An investor who is less risk averse should optimally choose a portfolio with more invested in the risky asset portfolio and less invested in the risk-free asset.

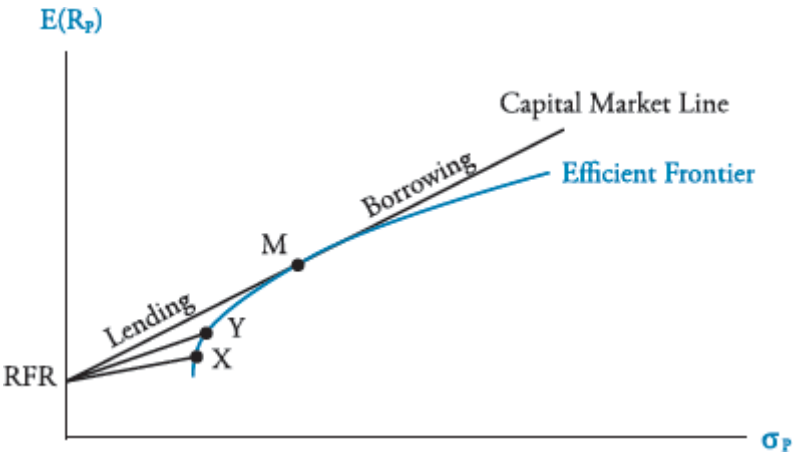
Figure 6: Portfolio Choices Based on Investor's Indifference Curves



Portfolio Risk And Return: Part II

The following figure illustrates the possible risk-return combinations from combining a risk-free asset with three different (efficient) risky portfolios: X, Y, and M.

Figure 7: Combining a Risk-Free Asset With a Risky Portfolio



This figure also illustrates the point that combining a risk-free asset with risky Portfolio M (the *tangency* portfolio) results in the best available set of risk and return opportunities. Combining the risk-free asset with either Portfolio X or Portfolio Y results in a less preferred set of possible portfolios.

Since all investors who hold any risky assets will choose to hold Portfolio M, it must contain *all* available risky assets, and we can describe it as the "market portfolio."

Investors at Point M have 100% of their funds invested in Portfolio M. Between R_f and M, investors hold both the risk-free asset and Portfolio M. This means investors are *lending* some of their funds at the risk-free rate and investing the rest in the risky market Portfolio M. To the right of M, investors hold more than 100% of Portfolio M. This means they are *borrowing* funds to buy more of Portfolio M. The *levered positions* represent a 100% investment in Portfolio M and borrowing to invest even more in Portfolio M.

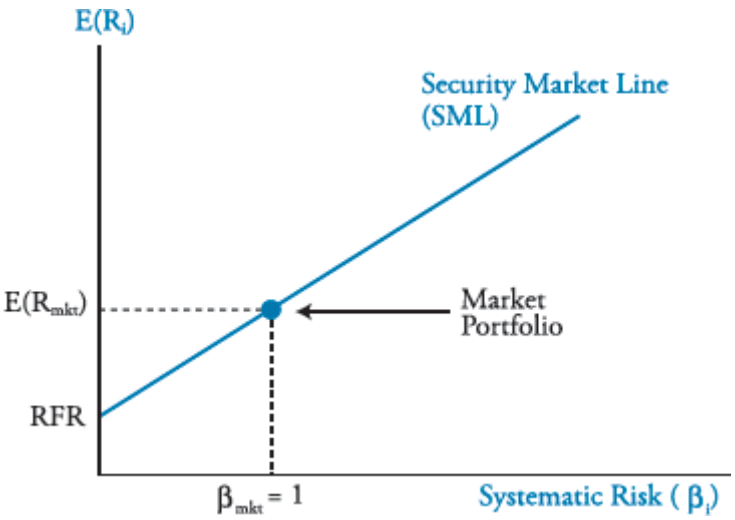
In short, adding a risk-free asset to the set of risky assets considered in the Markowitz portfolio theory results in a new efficient frontier that is now a straight line, the capital market line (CML).

Security Market Line Systematic and Unsystematic Risk

Under the assumptions of capital market theory, diversification is costless, and investors will only hold efficient portfolios. The risk that is eliminated by diversification is called *unsystematic risk* (also referred to as unique, diversifiable, or firm-specific risk). Since unsystematic risk is assumed to be eliminated at no cost, investors need not be compensated in equilibrium for bearing unsystematic risk.

The risk that remains in efficient portfolios is termed *systematic risk* (also referred to as non-diversifiable or market risk), which is measured by an asset's or portfolio's beta. This crucial result is the basis for the capital asset pricing model (CAPM). The equilibrium relationship between systematic risk and expected return is illustrated by the security market line (SML) as shown in Figure 8.

Figure 8: Security Market Line



The *total risk* (standard deviation of returns) for any asset or portfolio of assets can be separated into systematic and unsystematic risk.

$$\text{total risk} = \text{systematic risk} + \text{unsystematic risk}$$

Well-diversified (efficient) portfolios have no unsystematic risk, and a risk-free asset has no systematic (market) risk either. Systematic risk is measured in units of market risk, referred to as the beta of an asset or portfolio, so that the beta of the market portfolio is equal to one. The market portfolio simply has one "unit" of market risk.

$$\text{CAPM: } E(R_i) = RFR + [E(R_{MKT}) - RFR] \times \text{beta}_i$$

Note that required return and expected return are the same in equilibrium.

Return Generating Models

Return generating models are used to estimate the expected returns on risky securities based on specific factors. For each security, we must estimate the sensitivity of its returns to each factor included in the model. Factors that explain security returns can be classified as macroeconomic, fundamental, and statistical factors.

Multifactor models most commonly use macroeconomic factors such as GDP growth, inflation, or consumer confidence, along with fundamental factors such as earnings, earnings growth, firm size, and research expenditures.

The general form of a multifactor model with *k* risk factors is as follows:

$$E(R_i) - R_f = \beta_{i1} \times E(\text{Factor 1}) + \beta_{i2} \times E(\text{Factor 2}) + \ldots + \beta_{ik} \times E(\text{Factor k})$$

This model states that the expected excess return (above the risk-free rate) for Asset *i* is the sum of each **factor sensitivity** or **factor loading** (the *β*s) for Asset *i* multiplied by the expected value of that factor for the period. The first factor is often the expected excess return on the market, $E(R_m) - R_f$.

One multifactor model that is often used is that of Fama and French. They estimated the sensitivity of security returns to three factors: firm size, firm book value to market value ratio, and the return on the market portfolio minus the risk-free rate (excess return on the market portfolio). Carhart suggests a fourth factor that measures price momentum using prior period returns. Together, these four factors do a relatively good job of explaining returns differences for U.S. equity securities over the period for which the model has been estimated.

The **market model** is a single factor (sometimes termed single index) model. The only factor is the expected return on the market portfolio (market index).

The form of the market model is:

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

where:

R_i = Return on Asset *i*

R_m = Market return

β_i = Slope coefficient

α_i = Intercept

e_i = Abnormal return on Asset *i*

In the market model, the beta (factor sensitivity) of Asset *i* is a measure of the sensitivity of the return on Asset *i* to the return on the market portfolio.

Beta

The sensitivity of an asset's return to the return on the market index in the context of the market model is referred to as its **beta**. Beta is a standardized measure of the covariance of the asset's return with the market return. Beta can be calculated as follows:

$$\beta_i = \frac{\text{covariance of Asset i's return with the market return}}{\text{variance of the market return}} = \frac{Cov_{im}}{\sigma_m^2}$$

We can use the definition of the correlation between the returns on Asset i with the returns on the market index:

$$\rho_{im} = \frac{Cov_{im}}{\sigma_i \sigma_m}$$

$$\text{to get } Cov_{im} = \rho_{im} \sigma_i \sigma_m.$$

Substituting for Cov_{im} in the equation for B_i, we can also calculate beta as:

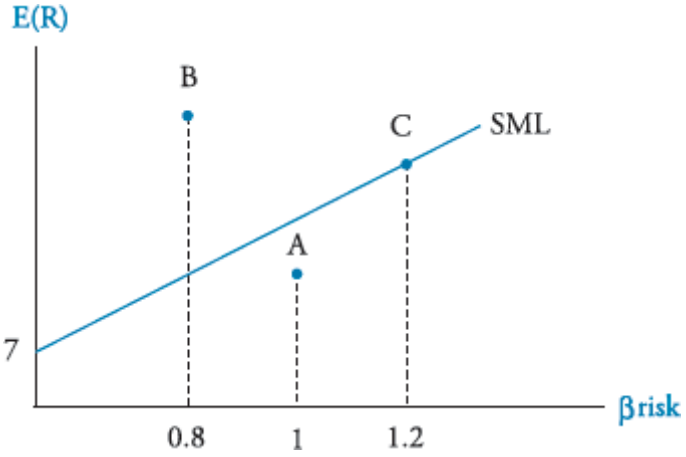
$$\beta_i = \frac{\rho_{im} \sigma_i \sigma_m}{\sigma_m^2} = \rho_{im} \frac{\sigma_i}{\sigma_m}$$

SML and Equilibrium

You should be able to compute an asset's expected return using the SML and determine whether the asset is underpriced or overpriced relative to its equilibrium value. In solving problems, be careful to note whether you are given the expected return on the market, $E(R_M)$, or the market risk premium, $E(R_M) - R_f$.

An analyst may identify assets for which his forecasted returns differ from the expected return based on the asset's beta. Assets for which the forecasted return differs from its equilibrium expected returns will plot either above or below the SML. Consider three stocks, A, B, and C, that are plotted on the SML diagram in Figure 9 based on their forecast returns.

Figure 9: Identifying Mispriced Securities



According to the forecasts, Asset B is underpriced, Asset A is overpriced, and Asset C is priced at its equilibrium value.

Performance evaluation of an active manager's portfolio choices refers to the analysis of the risk and return of the portfolio. **Attribution analysis**, an analysis of the sources of returns differences between the active portfolio returns and those of a passive benchmark portfolio, is also part of performance evaluation.

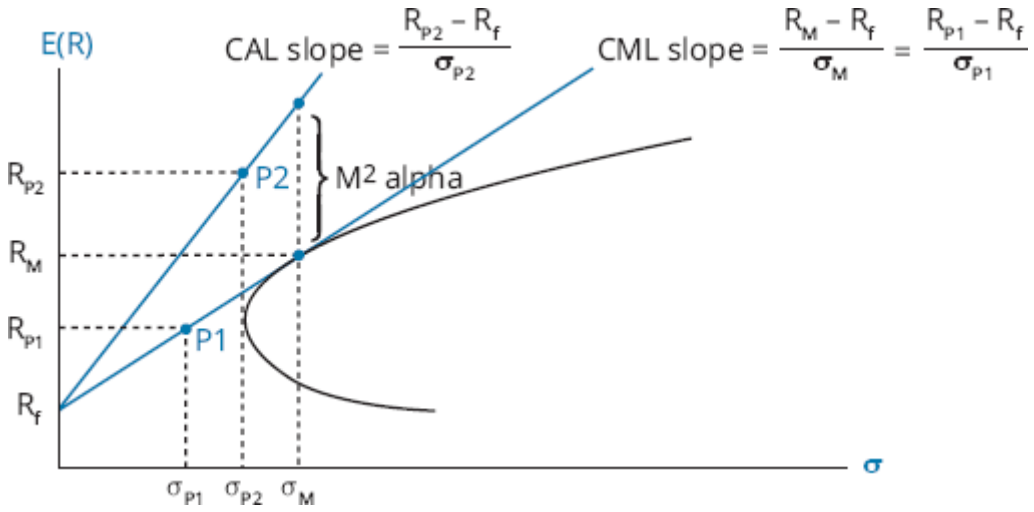
A portfolio with greater risk than the benchmark portfolio (especially beta risk) is expected to produce higher returns over time than the benchmark portfolio. When evaluating the performance of a portfolio with risk that differs from that of a benchmark portfolio, we need to adjust active portfolio return's risk. Of the alternative ways to measure risk-adjusted returns, the most commonly used is the **Sharpe ratio**, which is its *excess returns per unit of total portfolio risk*. Higher Sharpe ratios indicate better risk-adjusted portfolio performance.

$$\text{Sharpe ratio} = \frac{E[R_{portfolio}] - R_f}{\sigma_{portfolio}}$$

Because the Sharpe ratio is based on total risk (standard deviation of returns), it can be used to measure the risk-adjusted returns of portfolios that have unsystematic (firm-specific) risk.

In Figure 10, we illustrate that the Sharpe ratio is the slope of the CAL for a portfolio and can be compared to the slope of the CML to evaluate risk-adjusted performance.

Figure 10: Sharpe Ratios as Slopes



The **M-squared** (M^2) measure produces the same portfolio rankings as the Sharpe ratio but is stated in percentage terms (as illustrated in Figure 10). It is calculated for Portfolio 2 as:

$$R_f + (R_{P2} - R_f)\frac{\sigma_M}{\sigma_{P2}}$$

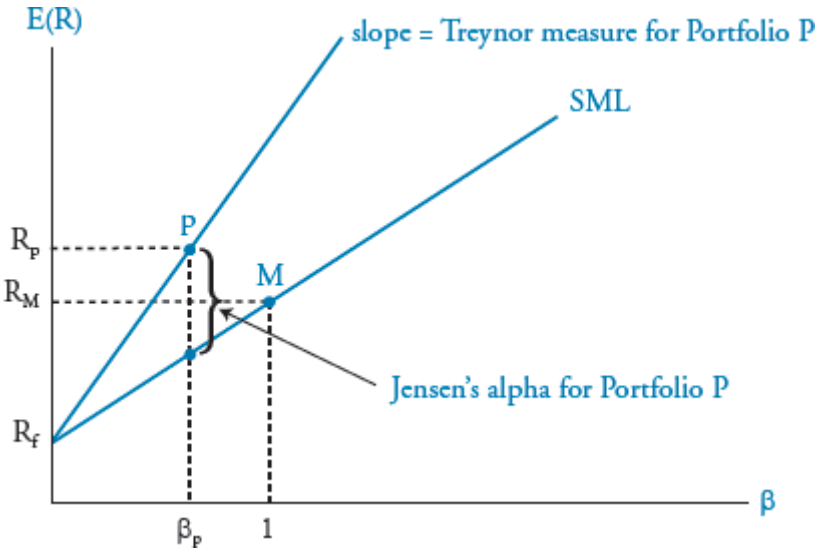
The extra return on portfolio P2 above the return on the market portfolio is referred to as its **M^2 alpha**. The difference between the Sharpe ratio and M^2 measure is that Sharpe is a slope measure and M^2 is measured in percentage terms. M^2 is also considered a measure of **risk-adjusted performance (RAP)**.

Two measures of portfolio performance based on systematic (beta) risk rather than total risk are the **Treynor measure** and **Jensen's alpha**. They are analogous to the Sharpe ratio and M^2 measures in that the Treynor measure is a measure of slope and Jensen's alpha is in percentage returns.

The Treynor measure is calculated as $\frac{R_P - R_f}{\beta_P}$, interpreted as excess returns per unit of systematic risk, and represented by the slope of a line as illustrated in Figure 11.

Jensen's alpha for Portfolio P is calculated as $\alpha_P = (R_P - R_f) - \beta_P(R_M - R_f)$ and is the percentage portfolio return above that of a portfolio (or security) with the same beta as the portfolio that lies on the SML, as illustrated in Figure 11.

Figure 11: Treynor Measure and Jensen's Alpha



BASICS OF PORTFOLIO PLANNING AND CONSTRUCTION

Importance of Investment Policy Statement

Understand the basic inputs to an investment policy statement and how these inputs relate to individuals, pensions, and endowments.

- The policy statement requires that risks and costs of investing, as well as the return requirements, all be objectively and realistically articulated.
- The policy statement imposes investment discipline on, and provides guidance for, both the client and the portfolio manager.

The major components of an IPS typically address the following:

- *Description of Client* circumstances, situation, and investment objectives.
- *Statement of the Purpose* of the IPS.
- *Statement of Duties and Responsibilities* of investment manager, custodian of assets, and the client.
- *Procedures* to update IPS and to respond to various possible situations.
- *Investment Objectives* derived from communications with the client.
- *Investment Constraints* that must be considered in the plan.
- *Investment Guidelines* such as how the policy will be executed, asset types permitted, and leverage to be used.
- *Evaluation of Performance*, the benchmark portfolio for evaluating investment performance, and other information on evaluation of investment results.
- *Appendices* containing information on strategic (baseline) asset allocation and permitted deviations from policy portfolio allocations, as well as how and when the portfolio allocations should be rebalanced.

Risk and Return Objectives

Absolute risk objectives can be stated in terms of the probability of specific portfolio results, either percentage losses or dollar losses, or in terms of strict limits on portfolio results. An absolute return objective may be stated in nominal terms, such as "an overall return of at least 6% per annum," or in real returns, such as "a return of 3% more than the annual inflation rate each year."

Relative risk objectives relate to a specific benchmark and can also be strict, such as, "Returns will not be less than the yield on 1-year government debt over any 12-month period," or stated in terms of probability, such as, "No greater than a 5% probability of returns more than 4% below the return on the MSCI World Index over any 12-month period."

The account manager must make sure that the stated risk and **return objectives** are compatible, given the reality of expected investment results and uncertainty over time.

Risk Tolerance

An investor's **ability to bear risk** depends on financial circumstances. Longer investment horizons (20 years rather than 2 years), greater assets versus liabilities (more wealth), more insurance against unexpected occurrences, and a secure job all suggest a greater ability to bear investment risk.

An investor's **willingness to bear risk** is based primarily on the investor's attitudes and beliefs about investments (various asset types).

If the investor's willingness to take on investment risk is high but the investor's ability to take on risk is low, the low ability to take on investment risk will prevail in the advisor's assessment.

In situations where ability is high but willingness is low, the advisor may attempt to educate the investor about investment risk and correct any misconceptions.

Investment Objectives and Constraints

The investment policy statement should include the following:

Investment objectives:

- Return objectives.
- Risk tolerance.

Constraints:

- Liquidity needs.
- Time horizon.
- Tax concerns.
- Legal and regulatory factors.
- Unique needs and preferences.

Asset Allocation

After having determined the investor objectives and constraints, a **strategic asset allocation** is developed which specifies the percentage allocations to the included asset

classes. In choosing asset classes for an account, the correlations of returns *within* an asset class should be relatively high, and the correlations of returns *between* asset classes should be relatively low in comparison.

Once the portfolio manager has identified the investable asset classes for the portfolio, an *efficient frontier* can be constructed and the manager can identify that portfolio (the strategic asset allocation) which best meets the risk and return requirements of the investor.

A manager who varies from strategic asset allocation weights in order to take advantage of perceived short-term opportunities is adding **tactical asset allocation** to the portfolio strategy. **Security selection** refers to deviations from index weights on individual securities within an asset class.

ESG Considerations in Portfolio Planning and Construction

If a portfolio's investment universe is constrained by **negative screening**, measuring its performance against a broad market index is unlikely to be appropriate. Indexes are available that exclude companies or industries that investors with ESG concerns commonly avoid.

Investors using a **positive screening** or **best-in-class** approach invest in companies that have positive ESG practices. Which companies to invest in, and which ESG practices to focus on, differ among investors. Thus, portfolios and performance benchmarks must be customized under these approaches. Similarly, **thematic investing** may require an investment manager who specializes in this style of investing.

For investment managers with clients who wish to engage in **active ownership**, it is important to clarify whether the clients intend to vote their shares themselves or direct the managers to vote the shares according to specified ESG factors.

Imposing constraints based on ESG factors will likely affect portfolio performance. Limiting the universe of investment choices and incurring the costs involved in considering ESG factors may decrease returns. On the other hand, investing in companies with good corporate governance practices and avoiding those that face ESG-related risks may increase portfolio returns.

THE BEHAVIORAL BIASES OF INDIVIDUALS

Cognitive Errors vs. Emotional Biases

Behavioral finance asserts that certain biases are widespread and therefore predictable. These can be classified as cognitive errors and emotional biases.

Cognitive errors may arise from not understanding statistical analysis, information processing errors, illogical reasoning, or memory errors. The two major categories of cognitive errors are *belief perseverance* and *information processing biases*. Cognitive errors can be addressed with increased awareness, better training, or more information.

Emotional biases are not related to conscious thought. Rather, they stem from feelings, impulses, or intuition. As such, they are difficult to overcome and may have to be

accommodated.

A behavioral bias may have elements of both cognition and emotion. When trying to mitigate biases that are both emotional and cognitive, success is more likely by focusing on the cognitive aspect.

Cognitive Errors: Belief Perseverance Biases

When an individual holds conflicting beliefs or receives information that challenges a current belief, **cognitive dissonance** causes stress that individuals seek to reduce. They may do so by letting go of prior beliefs or by discounting the conflicting information. Because doing the latter is often easier, individuals tend to exhibit **belief perseverance**—bias in favor of their currently held beliefs.

Types of belief perseverance biases include the following:

- **Conservatism bias.** Market participants rationally form an initial view but then fail to change that view as new information becomes available.
- **Confirmation bias.** Market participants seek out information that supports their prior beliefs but avoid or discount the importance of conflicting information.
- **Representativeness bias.** Market participants use certain characteristics to put an investment in a category and conclude that it will have the characteristics of investments in that category. Examples include **base-rate neglect** (analyzing an individual member of a population without adequately considering the probability of a characteristic in that population) and **sample-size neglect** (making a classification based on a small and potentially unrealistic sample).
- **Illusion of control bias.** Market participants believe they can control or affect outcomes when they cannot.
- **Hindsight bias.** Market participants have selective memories, resulting in a tendency to see things as more predictable than they really are (i.e., the "I knew it all along" phenomenon).

Cognitive Errors: Information Processing Biases

These are related more to the processing of information and less to the decision-making process. Types of information processing biases include the following:

1. **Anchoring and adjustment bias.** Market participants base expectations on a prior number and overweight its importance, making adjustments in relation to that number as new information arrives.
2. **Mental accounting bias.** Market participants view money in different accounts or from different sources differently when making investment decisions, as opposed to viewing them in a portfolio context.
3. **Framing bias.** The ways in which questions are phrased or data are presented can influence how market participants respond to them.
4. **Availability bias.** Market participants judge the probability of an event by the ease with which examples come to mind.

Emotional Biases

These six biases generally arise from emotions and feelings rather than through conscious thought:

1. **Loss-aversion bias** arises from feeling more pain from a loss than pleasure from an equal gain.
2. **Overconfidence bias** occurs when market participants overestimate their own investing ability. Examples include the following:
   – **Illusion of knowledge.** Market participants think they do a better job of predicting than they actually do.
   – **Self-attribution.** Market participants give themselves personal credit when things go right but blame others or circumstances when things go wrong.
   – **Prediction overconfidence.** Market participants underestimate uncertainty and the standard deviation of their predictions.
   – **Certainty overconfidence.** Market participants overestimate the probability they will be right.
3. **Self-control bias** occurs when individuals lack self-discipline and favor short-term satisfaction over long-term goals. They may exhibit **hyperbolic discounting**, favoring small payoffs now at the expense of larger payoffs in the future.
4. **Status quo bias** occurs when comfort with an existing situation causes an individual to be resistant to change. For example, a choice is more likely if it will happen unless the individual opts out than if the individual must choose to opt in.
5. **Endowment bias** occurs when an asset is felt to be more valuable simply because it is already owned.
6. **Regret-aversion bias** occurs when market participants fail to take an investment action out of excessive fear that actions could be wrong. **Herding behavior** is a form of regret aversion where participants go with the consensus or popular opinion, telling themselves they are not to blame if others are wrong too.

Behavioral Biases and Market Anomalies

Behavioral biases may contribute to market anomalies such as asset price bubbles and subsequent crashes. Overconfidence may lead to overtrading, underestimation of risk, and lack of diversification. Persistently good results combined with self-attribution bias can fuel overconfidence, as can hindsight bias as investors give themselves credit for choosing profitable stocks in a bull market. Confirmation bias may lead investors to ignore or misinterpret new information suggesting that valuations will not continue to rise or to misinterpret initial decreases in asset values as simply another buying opportunity. Anchoring may cause investors to believe recent highs are rational prices, even after prices begin their eventual decline. Regret aversion may keep even very skeptical investors in the market.

Another anomaly that may result from behavioral factors is the seeming outperformance of value stocks versus growth stocks. The **halo effect** is a version of representativeness in which fast growth and a rising stock price lead market participants to conclude that a stock is a good one to own, leading growth stocks to be overvalued.

Home bias refers to market participants' tendency to invest heavily in firms in their domestic country or more heavily in firms operating in their region. This may result from a belief that they have better access to information or simply an emotional desire to invest in companies "closer to home."

INTRODUCTION TO RISK MANAGEMENT

Risk (uncertainty) is not something to be avoided by an organization or in an investment portfolio; returns above the risk-free rate are earned only by accepting risk. The risk management process seeks to (1) determine the risk tolerance of the organization, (2) identify and measure the risks the organization faces, and (3) modify and monitor these risks. Through these choices, a firm aligns the risks it takes with its risk tolerance after considering which risks the organization is best able to bear.

An overall risk management framework encompasses several activities, including:

- Establishing processes and policies for risk governance.
- Determining the organization's risk tolerance.
- Identifying and measuring existing risks.
- Managing and mitigating risks to achieve the optimal bundle of risks.
- Monitoring risk exposures over time.
- Communicating across the organization.
- Performing strategic risk analysis.

Risk governance provides organization-wide guidance on which risks should be pursued in an efficient manner, which should be subject to limits, and which should be reduced or avoided. A risk management committee can provide a way for various parts of the organization to bring up issues of risk measurement, integration of risks, and the best ways to mitigate undesirable risks.

Determining an organization's **risk tolerance** involves setting the overall risk exposure the organization will take by identifying the risks the firm can effectively take and the risks that the organization should reduce or avoid. Some of the factors that determine an organization's risk tolerance are its expertise in its lines of business, its skill at responding to negative outside events, its regulatory environment, and its financial strength and ability to withstand losses.

Risk budgeting is the process of allocating firm resources to assets or investments by considering their risk characteristics and how they combine to meet the organization's risk tolerance. The goal is to allocate the overall amount of acceptable risk to the mix of assets or investments that have the greatest expected returns over time. The risk budget may be a single metric, such as portfolio beta, value at risk, portfolio duration, or returns variance.

Financial risks are those that arise from exposure to financial markets. Examples are:

- *Credit risk*. This is the uncertainty about whether the counterparty to a transaction will fulfill its contractual obligations.
- *Liquidity risk*. This is the risk of loss when selling an asset at a time when market conditions make the sales price less than the underlying fair value of the asset.

- *Market risk*. This is the uncertainty about market prices of assets (stocks, commodities, and currencies) and interest rates.

Nonfinancial risks arise from the operations of the organization and from sources external to the organization. Examples are:

- *Operational risk*. This is the risk that human error, faulty organizational processes, inadequate security, or business interruptions will result in losses.
- *Solvency risk*. This is the risk that the organization will be unable to continue to operate because it has run out of cash.
- *Regulatory risk*. This is the risk that the regulatory environment will change, imposing costs on the firm or restricting its activities.
- *Governmental or political risk* (including *tax risk*). This is the risk that political actions outside a specific regulatory framework, such as increases in tax rates, will impose significant costs on an organization.
- *Legal risk*. This is the uncertainty about the organization's exposure to future legal action.
- *Model risk*. This is the risk that asset valuations based on the organization's analytical models are incorrect.
- *Tail risk*. This is the risk that extreme events (those in the tails of the distribution of outcomes) are more likely than the organization's analysis indicates, especially from incorrectly concluding that the distribution of outcomes is normal.
- *Accounting risk*. This is the risk that the organization's accounting policies and estimates are judged to be incorrect.

The various risks an organization faces interact in many ways. Interactions among risks can be especially important during periods of stress in financial markets.

Measures of risk for specific asset types include standard deviation, beta, and duration.

- *Standard deviation* is a measure of the volatility of asset prices and interest rates. Standard deviation may not be the appropriate measure of risk for non-normal probability distributions, especially those with negative skew or positive excess kurtosis (fat tails).
- *Beta* measures the market risk of equity securities and portfolios of equity securities. This measure considers the risk reduction benefits of diversification and is appropriate for securities held in a well-diversified portfolio, whereas standard deviation is a measure of risk on a stand-alone basis.
- *Duration* is a measure of the price sensitivity of debt securities to changes in interest rates.

Derivatives risks (sometimes referred to as "the Greeks") include:

- *Delta*. This is the sensitivity of derivatives values to the price of the underlying asset.
- *Gamma*. This is the sensitivity of delta to changes in the price of the underlying asset.
- *Vega*. This is the sensitivity of derivatives values to the volatility of the price of the underlying asset.
- *Rho*. This is the sensitivity of derivatives values to changes in the risk-free rate.

Tail risk or **downside risk** is the uncertainty about the probability of extreme negative outcomes. Commonly used measures of tail risk include **value at risk (VaR)**, the minimum

loss over a period that will occur with a specific probability, and conditional VaR (CVaR), the expected value of a loss, given that the loss exceeds a given amount.

Two methods of risk assessment that are used to supplement measures such as VaR and CVaR are stress testing and scenario analysis. **Stress testing** examines the effects of a specific (usually extreme) change in a key variable. **Scenario analysis** refers to a similar what-if analysis of expected loss but incorporates specific changes in multiple inputs.

Once the risk management team has estimated various risks, management may decide to *avoid* a risk, *prevent* a risk, *accept* a risk, *transfer* a risk, or *shift* a risk.

- One way to *avoid* a risk is to not engage in the activity with the uncertain outcome.
- Some risks can be *prevented* by increasing the level of security and adopting stronger processes.
- For risks that management has decided to *accept*, the organization will seek to bear them efficiently, often through diversification. The term **self-insurance** of a risk refers to a risk an organization has decided to bear.
- With a risk *transfer*, a risk is transferred to another party. Insurance is a type of risk transfer. With a **surety bond**, an insurance company agrees to make a payment if a third party fails to perform under the terms of a contract. A **fidelity bond** pays for losses resulting from employee theft or misconduct.
- Risk *shifting* is a way to change the distribution of possible outcomes and is accomplished primarily with derivative contracts.

TECHNICAL ANALYSIS

Focus on the basics of technical analysis and its underlying assumptions.

Principles of Technical Analysis

1. Market prices reflect all known information.
2. Market prices exhibit trends and countertrends.
3. Patterns and cycles repeat in predictable ways.

Technical Analysis and Behavioral Finance

Research in behavioral finance has indicated that investor behavior may reflect both rational and irrational decisions. Technical analysis assumes market prices reflect both rational and irrational investor behavior, which is reflected in trends and patterns that repeat and can be used for forecasting price movements. This implies that *technical analysts believe the efficient markets hypothesis does not hold.*

Technical Analysis and Fundamental Analysis

While fundamental analysis uses the company's financial statements and other information to determine its value, technical analysis uses only its share price and trading volume data to project a target price. Technical analysis is not concerned with identifying

buyers' and sellers' reasons for trading; it is concerned only with the trades that have occurred.

An advantage of only using actual price and volume data is that they are observable. Much of the data used in fundamental analysis is subject to assumptions or restatements, and for assets such as currencies or commodities, it might not be available at all. Another advantage of technical analysis is that it can be applied to assets that do not produce future cash flows.

Technical analysis can also be useful when financial statement fraud occurs. Price and volume may reflect the true value of the company even before the fraud is widely known and before the financial statements are restated.

Technical analysis may be less useful if price and volume data do not truly reflect supply and demand. This may be the case when markets are illiquid or subject to outside manipulation such as currency market intervention.

Types of Charts

All of the following chart types plot price or volume on the vertical axis and time (divided into trading periods) on the horizontal axis. Trading periods can be daily, intraday (e.g., hourly), or longer term (e.g., weekly or monthly).

Line chart. Closing prices for each trading period are connected by a line.

Bar chart. Vertical lines display the high to the low price for each trading period. A mark on the left side of the line indicates the opening price and a mark on the right side of the vertical line indicates the closing price.

Candlestick chart. This is a bar chart that draws a box from the opening price to the closing price on the vertical line for each trading period. The box is empty if the close is higher than the open and filled if the close is lower than the open.

Volume chart. A vertical line runs from zero to the number of shares (bonds, contracts) exchanged during each trading period. It is often displayed below a bar or candlestick chart of the same asset over the same range of time.

Relative strength chart. This is a line chart of the ratio of closing prices of two assets, or one asset and a benchmark index. These charts illustrate how one asset or market is performing relative to another. Relative strength charts are useful for performing intermarket analysis and for identifying attractive asset classes and assets within each class that are outperforming others.

Trend, Support, and Resistance

A market is in an **uptrend** if prices are consistently reaching higher highs and retracing to higher lows. An uptrend indicates demand is increasing relative to supply. An upward-sloping trend line connects the low points for a stock in an uptrend.

A market is in a **downtrend** if prices are consistently reaching lower lows and retracing to lower highs. A downtrend means supply is increasing relative to demand. A downward-sloping trend line connects the high points in a downtrend.

Support and resistance levels are prices at which technical analysts expect supply and demand to equalize. Past highs are viewed as resistance levels, and past lows are viewed as support levels. Trend lines are also thought to indicate support and resistance levels.

The **change in polarity principle** is based on a belief that breached support levels become resistance levels, and breached resistance levels become support levels.

Common Chart Patterns

Reversal patterns include head-and-shoulders, double top, triple top, inverse head-and-shoulders, double bottom, and triple bottom. These price patterns are thought to indicate that the preceding trend has run its course and a new trend in the opposite direction is likely to emerge.

Continuation patterns include triangles, rectangles, flags, and pennants. These indicate temporary pauses in a trend that is expected to continue (in the same direction).

Technical analysts often use the sizes of both of these types of patterns to estimate subsequent target prices for the next move.

Price-Based Indicators

Moving average lines are a frequently used method to smooth the fluctuations in a price chart. A 20-day moving average is the arithmetic mean of the last 20 closing prices. The larger number of periods chosen, the smoother the resulting moving average line will be. Moving average lines can help illustrate trends by smoothing short-term fluctuations, but when the number of periods is large, a moving average line can obscure changes in trend.

Bollinger bands are drawn a given number of standard deviations above and below a moving average line. Prices are believed to have a higher probability of falling (rising) when they are near the upper (lower) band. The **Bollinger band width indicator** is the difference between the upper and lower bands as a percentage of the moving average and is used to identify periods of unusually low or high volatility.

Momentum oscillators include the rate of change oscillator, the Relative Strength Index (RSI), moving average convergence/divergence (MACD) lines, and stochastic oscillators.

Technical analysts use price-based indicators to identify market conditions that are overbought (prices have increased too rapidly and are likely to decrease in the near term) or oversold (prices have decreased too rapidly and are likely to increase in the near term). They also use charts of momentum oscillators to identify convergence or divergence with price trends. **Convergence** occurs when the oscillator shows the same pattern as prices (e.g., both reaching higher highs). **Divergence** occurs when the oscillator shows a different pattern than prices (e.g., failing to reach a higher high when the price does). Convergence suggests the price trend is likely to continue, while divergence indicates a potential change in trend.

Non–Price-Based Indicators

While the indicators mentioned so far assume investor sentiment is reflected in price and volume data, technical analysts also look at non-price indicators of investor sentiment.

Sentiment is said to be bullish when investors expect increasing prices and bearish when they expect decreasing prices.

Sentiment indicators include the following:

- **Put/call ratio.** Put option volume divided by call option volume. Technical analysts typically use this ratio as a contrarian indicator. High ratios indicate strongly bearish investor sentiment and possibly an oversold market, while low ratios indicate strongly bullish sentiment and perhaps an overbought market.
- **Volatility index (VIX).** Measure of volatility on S&P 500 stock index options. High levels suggest investors fear declines in the stock market. Technical analysts most often interpret the VIX in a contrarian way, viewing a predominantly bearish outlook as a bullish sign.
- **Margin debt.** Increasing margin debt tends to coincide with increasing prices and decreasing margin debt tends to coincide with decreasing prices. Increases in total margin debt suggest aggressive buying by bullish margin investors. As these investors reach their margin credit limits, their ability to continue buying decreases, which can cause prices to begin declining.

Intermarket Analysis

Intermarket analysis looks at interrelationships among major asset classes, such as stocks, bonds, commodities, and currencies. After identifying attractive asset classes, an analyst can use relative strength charts to identify which assets within these classes are outperforming others. This approach is also useful for comparing the relative performance of equity market sectors or industries and of various international markets.

Technical Analysis and Portfolio Management

Technical analysis may be used to complement fundamental analysis using either a top-down or bottom-up portfolio management approach.

A top-down approach begins by examining economic growth, then analyzing how it is affecting the performance of market sectors, industry groups, and securities. Intermarket analysis using relative strength charts can identify markets and sectors that have outperformed relative to others. Portfolio managers may use this analysis to make tactical asset allocation decisions.

Bottom-up analysis uses the opposite approach, first identifying an investment universe or opportunity set, then narrowing it using criteria chosen by the analyst. These criteria may include technical analysis indicators or chart patterns.

A bottom-up approach can complement a top-down approach. For example, if several stocks in an industry exhibit technical patterns indicating selling pressure, it may be that this industry as a whole is likely to underperform.

FINTECH IN INVESTMENT MANAGEMENT

Fintech refers to advances in technology applied in the financial services industry. Areas where fintech is being applied include analysis of large data sets, artificial intelligence,

recordkeeping, and automation of portfolio management, trading, compliance, and client advisory services.

Big Data

The term **Big Data** refers to the very large datasets that have become available with advances in technology. These datasets include data from traditional sources, such as financial markets, company financial reports, and government economic statistics, as well as from nontraditional sources (alternative data) such as individuals (social media posts, online reviews, email, texts, website visits), businesses (bank records, retail scanner data, and other such **corporate exhaust**), and sensors and devices (the **Internet of Things**).

Characteristics of Big Data

- Large size: Volume of traditional and alternative data continues to grow by orders of magnitude, from gigabytes to terabytes (1,000 gigabytes) and even petabytes (1,000 terabytes).
- High velocity: Much of the new data is communicated in real time or very close to it (low latency). Other data are collected periodically.
- Variety: The data comes from many sources in several formats including structured (e.g., databases), semi-structured (e.g., photos and web page code), and unstructured (e.g., video, text, voice).

Processing, organizing, and analyzing Big Data can be especially problematic with qualitative unstructured data. This is done using **artificial intelligence**, computer systems that can be programmed to simulate human cognition. **Neural networks**, one example of artificial intelligence, are programmed to process information in a way similar to that of a human brain.

In machine learning, a computer algorithm is used to model output data based on input data and improve the accuracy of the output data over time by recognizing patterns in and relationships with the input data.

- In **supervised learning**, the input and output data are labelled, the machine learns to model the outputs from the inputs, and then given input data to predict outputs.
- In **unsupervised learning**, the input data are not labelled, and the machine must also structure the data as part of its learning process.

Deep learning is a technique that uses layers of neural networks to identify patterns, beginning with simple patterns and advancing to more complex ones. Applications of deep learning include image and speech recognition.

Overfitting occurs when a fitted model treats noise in the input data as true parameters, identifying spurious patterns and relationships. **Underfitting** occurs when a model treats parameters as noise, failing to fully use the information in actual patterns and relationships.

Fintech Applications

Text analytics refers to the analysis of unstructured data in text data. Text analytics are used to automate specific tasks such as data retrieval, evaluating company filings for positive or negative indicators, and tracking consumer sentiment.

Natural language processing (NLP) refers to the use of computers and artificial intelligence to interpret human language, greatly expanding the potential uses of text analytics. Applications in finance include checking regulatory compliance by examining employee communications and evaluating analyst calls, company reports, and other communications to detect more subtle changes in sentiment than can be discerned from analyst recommendations alone.

Algorithmic trading refers to computerized securities trading based on a set of rules. For example, algorithms may determine the optimal execution instructions for any given trade based on real-time prices and other market data. Another application of algorithmic trading is **high-frequency trading** that exploits very short term security mispricings, often across markets.

Robo-advisors are online platforms that provide automated investment advice (typically asset allocation) based on a customer's answers to survey questions about financial position, return objectives, risk tolerance, and constraints, among other things. Robo-advisor services may be fully automated or human-assisted.

Risk analysis can be improved using Big Data, AI, and machine learning. Scenario analysis (stress testing) is being done using AI. Fintech applications also include risk management and portfolio optimization for portfolio managers.

Distributed Ledger Technology (DLT)

A **distributed ledger** is a database that is shared on a network so that each participant has a copy. A distributed ledger must have a consensus mechanism to validate new entries into the ledger. DLT uses cryptography to ensure only authorized network participants can use the data. A **blockchain** is a distributed ledger that records transactions sequentially in blocks and links these blocks in a chain, providing a continuous record of trades and ownership.

Cryptocurrencies, such as Bitcoin, are another example of the use of DLT in finance. DLT is used to record transactions, thereby verifying ownership of the cryptocurrency and the parties to a trade.

DLT has the potential to:

- Automate many of the processes currently carried out by custodians and other third parties to settle and record trades.
- Support real-time trade verification and settlement.
- Improve transparency and increase the efficiency and accuracy of regulatory compliance and reporting.
- Support **smart contracts**, electronic contracts that can self-execute based on terms agreed to by the counterparties.
- Support **tokenization**, electronic proof of ownership of physical assets, which would greatly reduce time and cost when verification of ownership is currently a manual paper-based process (e.g., real estate).

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[1] 2018 Ibbotson SBBI Yearbook.

ETHICAL AND PROFESSIONAL STANDARDS

Weight on Exam	15% to 20%
SchweserNotes™ Reference	Book 5, Pages 137–201

Ethics is 15% to 20% of the Level I examination and is extremely important to your overall success (remember, you can fail a topic area and still pass the exam, but we wouldn't recommend failing Ethics). Ethics can be tricky, and small details can be important on some ethics questions. Be prepared.

In addition to starting early, study the ethics material more than once. Ethics is one of the keys to passing the exam.

ETHICS AND TRUST IN THE INVESTMENT PROFESSION

Ethics can be described as a set of shared beliefs about what behavior is good or acceptable.

Ethical conduct has been described as behavior that follows moral principles and is consistent with society's ethical expectations and also as conduct that improves outcomes for stakeholders, those who are directly or indirectly affected by the conduct.

A **code of ethics** is a written set of moral principles that can guide behavior.

- Having a code of ethics is a way to communicate an organization's values, principles, and expectations.
- Some codes of ethics include a set of rules or standards that require some minimum level of ethical behavior.

A **profession** refers to a group of people with specialized skills and knowledge who serve others and agree to behave in accordance with a code of ethics. A profession may have the following characteristics:

- A code and standards for professional behavior.
- A regulatory body to enforce rules concerning professional behavior and monitor the ethical behavior of members.
- A focus on the needs of their clients (e.g., students, patients).
- A focus on service to society.
- A requirement to put client interests first.
- A focus on or requirement for continuing education.

Ways that professions establish trust include:

- Requiring high standards of expertise, knowledge, and skill.

- Establishing standards of ethical behavior.
- Monitoring professional conduct.
- Encouraging continuing education to maintain and increase competence.
- Being focused on clients' needs.
- Mentoring and inspiring others in the profession.

One challenge to ethical behavior is that individuals tend to overrate the ethical quality of their behavior and overemphasize the importance of their personal traits in determining the ethical quality of their behavior.

It is claimed that external or situational influences, such as social pressure from others or the prospect of acquiring more money or greater prestige, have a greater effect on the ethical quality of behavior than personal traits.

Some financial professionals are held to a **suitability standard**, while others are held to a **fiduciary standard**. Suitability refers to the match between client return requirements and risk tolerances and the characteristics of the securities recommended. A fiduciary standard is stronger, requiring professionals to use their knowledge and expertise to act in the best interests of the client.

Investment professionals have a special responsibility because they are entrusted with their clients' wealth. Because investment advice and management are intangible products, making quality and value received more difficult to evaluate than for tangible products, trust in investment professionals takes on an even greater importance. Failure to act in a highly ethical manner can damage not only client wealth but also impede the success of investment firms and investment professionals because potential investors will be less likely to use their services.

Unethical behavior by financial services professionals can have negative effects for society as a whole. A lack of trust in financial advisors will reduce the funds entrusted to them and increase the cost of raising capital for business investment and growth. Unethical behavior such as providing incomplete, misleading, or false information to investors can affect the allocation of the capital that is raised.

Ethical vs. Legal Standards

Not all unethical actions are illegal, and not all illegal actions are unethical. Acts of "whistleblowing" or civil disobedience that may be illegal in some places are considered by many to be ethical behavior. On the other hand, recommending investment in a relative's firm without disclosure may not be illegal, but would be considered unethical by many. Ethical principles often set a higher standard of behavior than laws and regulations. In general, ethical decisions require more judgment and consideration of the impact of behavior on many stakeholders compared to legal decisions.

Framework for Ethical Decision Making

Ethical decisions will be improved when ethics are integrated into a firm's decision-making process. The following ethical decision-making framework is presented in the Level I CFA curriculum:[1]

- Identify: Relevant facts, stakeholders and duties owed, ethical principles, conflicts of interest.
- Consider: Situational influences, additional guidance, alternative actions.
- Decide and act.
- Reflect: Was the outcome as anticipated? Why or why not?

CODE OF ETHICS AND STANDARDS OF PROFESSIONAL CONDUCT

We recommend you read the original *Standards of Practice Handbook*. Although we are very proud of our reviews of the ethics material, there are *two* reasons we recommend you read the original *Standards of Practice Handbook* (*11th Ed., 2014*). (1) You are a CFA candidate. As such, you have pledged to abide by the CFA Institute Standards. (2) Most of the ethics questions will likely come directly from the text and examples in the *Standards of Practice Handbook*. You will be much better off if you read both our summaries of the Standards *and* the original Handbook and all the examples presented in it.

The CFA Institute Professional Conduct Program is covered by the CFA Institute Bylaws and the Rules of Procedure for Proceedings Related to Professional Conduct. The Disciplinary Review Committee of the CFA Institute Board of Governors has overall responsibility for the Professional Conduct Program and enforcement of the Code and Standards.

CFA Institute, through the Professional Conduct staff, conducts inquiries related to professional conduct. Several circumstances can prompt such an inquiry:

- Self-disclosure by members or candidates on their annual Professional Conduct Statements of involvement in civil litigation or a criminal investigation, or that the member or candidate is the subject of a written complaint.
- Written complaints about a member or candidate's professional conduct that are received by the Professional Conduct staff.
- Evidence of misconduct by a member or candidate that the Professional Conduct staff received through public sources, such as a media article or broadcast.
- A report by a CFA exam proctor of a possible violation during the examination.
- Analysis of exam scores and materials and monitoring of websites and social media by CFA Institute.

Once an inquiry is begun, the Professional Conduct staff may request (in writing) an explanation from the subject member or candidate, and may:

- Interview the subject member or candidate.
- Interview the complainant or other third parties.
- Collect documents and records relevant to the investigation.

The Professional Conduct staff may decide:

- That no disciplinary sanctions are appropriate.
- To issue a cautionary letter.
- To discipline the member or candidate.

In a case where the Professional Conduct staff finds a violation has occurred and proposes a disciplinary sanction, the member or candidate may accept or reject the sanction. If the member or candidate chooses to reject the sanction, the matter will be referred to a panel of CFA Institute members for a hearing. Sanctions imposed may include condemnation by the member's peers or suspension of the candidate's continued participation in the CFA Program.

Code and Standards

Questions about the Code and Standards will most likely be application questions. You will be given a situation and be asked to identify whether or not a violation occurs, what the violation is, or what the appropriate course of action should be. You are not required to know the Standards by number, just by name.

The Code of Ethics states that members of CFA Institute [including CFA charterholders] and candidates for the CFA designation (Members and Candidates) must:

- Act with integrity, competence, diligence, and respect and in an ethical manner with the public, clients, prospective clients, employers, employees, colleagues in the investment profession, and other participants in the global capital markets.
- Place the integrity of the investment profession and the interests of clients above their own personal interests.
- Use reasonable care and exercise independent, professional judgment when conducting investment analysis, making investment recommendations, taking investment actions, and engaging in other professional activities.
- Practice and encourage others to practice in a professional and ethical manner that will reflect credit on themselves and the profession.
- Promote the integrity and viability of the global capital markets for the ultimate benefit of society.
- Maintain and improve their professional competence and strive to maintain and improve the competence of other investment professionals.

GUIDANCE FOR STANDARDS I–VII

The following is a list of the Standards of Professional Conduct. Candidates should focus on the purpose of the Standard, applications of the Standard, and proper procedures of compliance for each Standard.

The following is intended to offer a useful summary of the current Standards of Practice, but certainly does not take the place of careful reading of the Standards themselves, the guidance for implementing the Standards, and the examples in the Handbook.

1. Know the law relevant to your position.
   – Comply with the most strict law or Standard that applies to you.
   – Don't solicit gifts.
   – Don't compromise your objectivity or independence.
   – Use reasonable care.

– Don’t lie, cheat, or steal.
– Don’t continue association with others who are breaking laws, rules, or regulations.
– Don’t use others’ work or ideas without attribution.
– Don’t guarantee investment results or say that past results will be certainly repeated.
– Don’t do things outside of work that reflect poorly on your integrity or professional competence.

2. Do not act or cause others to act on material nonpublic information.
   – Do not manipulate market prices or trading volume with the intent to mislead others.
3. Act solely for the benefit of your client and know to whom a fiduciary duty is owed with regard to trust accounts and retirement accounts.
   – Treat clients fairly by attempting simultaneous dissemination of investment recommendations and changes.
   – Do not personally take shares in oversubscribed IPOs.

   When in an advisory relationship:
   – Know your client.
   – Make suitable recommendations/take suitable investment action (in a total portfolio context).
   – Preserve confidential client information unless it concerns illegal activity.
   – Do not try to mislead with performance presentation.
   – Vote nontrivial proxies in clients’ best interests.
4. Act for the benefit of your employer.
   – Do not harm your employer.
   – Obtain written permission to compete with your employer or to accept additional compensation from clients contingent on future performance.
   – Disclose (to employer) any gifts from clients.
   – Don’t take material with you when you leave employment (you can take what is in your brain).
   – Supervisors must take action to both prevent and detect violations.
   – Don’t take supervisory responsibility if you believe procedures are inadequate.
5. Thoroughly analyze investments.
   – Have reasonable basis.
   – Keep records.
   – Tell clients about investment process, including its risks and limitations.
   – Distinguish between facts and opinions.
   – Review the quality of third-party research and the services of external advisers.
   – In quantitative models, consider what happens when their inputs are outside the normal range.
6. Disclose potential conflicts of interest (let others judge the effects of any conflict for themselves).

– Disclose referral arrangements.
– Client transactions come before employer transactions, which come before personal transactions.
– Treat clients who are family members just like any client.

7. Don't cheat on *any* exams (or help others to).
   – Don't reveal CFA exam questions or disclose what topics were tested or not tested.
   – Don't use your Society position or any CFA Institute position or responsibility to *improperly* further your personal or professional goals.
   – Don't use the CFA designation improperly.
   – Don't put CFA in bold or bigger font than your name.
   – Don't put CFA in a pseudonym that conceals your identity, such as a social media account name.
   – Don't imply or say that holders of the CFA Charter produce better investment results.
   – Don't claim that passing all exams on the first try makes you a better investment manager than others.
   – Don't claim CFA candidacy unless registered for the next exam or awaiting results.
   – There is no such thing as a CFA Level I (or II, or III).

My goodness! What *can* you do?

– You can use information from recognized statistical sources without attribution.
– You can be wrong (as long as you had a reasonable basis at the time).
– You can use several pieces of nonmaterial, nonpublic information to construct your investment recommendations (mosaic theory).
– You can do large trades that may affect market prices as long as the intent of the trade is not to mislead market participants.
– You can say that Treasury securities are without default risk.
– You can always seek the guidance of your supervisor, compliance officer, or outside counsel.
– You can get rid of records after seven years.
– You can accept gifts from clients and referral fees as long as properly disclosed.
– You can call your biggest clients first (after fair distribution of investment recommendation or change).
– You can accept compensation from a company to write a research report if you disclose the relationship and nature of compensation.
– You can get drunk when not at work and commit misdemeanors that do not involve fraud, theft, or deceit.
– You can protest laws or policies you believe are unjust, even if you get arrested for doing so (civil disobedience).
– You can disclose otherwise confidential information to authorities to expose wrongdoing or protect the integrity of financial markets (whistleblowing).
– You can say you have passed the Level I, II, or III CFA exam (if you really have).

– You can accurately describe the nature of the examination process and the requirements to earn the right to use the CFA designation.

INTRODUCTION TO THE GLOBAL INVESTMENT PERFORMANCE STANDARDS (GIPS®)

Why GIPS Were Created

When firms choose their own methodologies for reporting investment performance, they tend to choose those that make their own performance look good. Examples include choosing a top-performing portfolio or an unusually good time period and claiming it represents the firm's overall results, as well as excluding accounts that clients terminated for poor performance.

CFA Institute created GIPS as a way to present a standardized methodology for performance reporting. Widespread usage of GIPS can make performance comparisons across firms meaningful, avoid misrepresentations of performance, and give oversight bodies a clearer understanding of the returns achieved and the risks taken by the firms they supervise.

Who GIPS Apply To

GIPS only apply to firms that actually manage assets. Presenting performance information compliant with GIPS is voluntary for such firms, but they may only claim compliance with GIPS if they comply fully and on a firmwide basis. Other firms related to the asset management business, such as software developers, may state that they endorse GIPS but may not claim compliance with GIPS.

GIPS Standards for Firms

The GIPS standards for firms consist of eight sections:

1. Fundamentals of Compliance
2. Input Data and Calculation Methodology
3. Composite and Pooled Fund Maintenance
4. Composite Time-Weighted Return Report
5. Composite Money-Weighted Return Report
6. Pooled Fund Time-Weighted Return Report
7. Pooled Fund Money-Weighted Return Report
8. GIPS Advertising Guidelines

Composites

A **composite** is a grouping of portfolios that a firm manages using a similar investment strategy, objective, or mandate. Reporting the performance of composites gives clients and prospects information about the firm's success in managing various types of securities and investment styles.

To comply with GIPS, a composite must include *all fee-paying, discretionary portfolios* (current and past) that the firm has managed with a particular strategy. All fee-paying discretionary accounts managed by the firm must be included in at least one composite. The firm must assign each portfolio to its composite before the portfolio's performance is known. This prevents firms from choosing portfolios selectively to create composites with artificially superior returns.

Definition of the Firm

For GIPS compliance, the *firm* is defined as the corporation, subsidiary, or division that is held out to clients as a business entity. The definition of the firm includes all of its geographic locations and their clients.

Definition of Discretion

Discretion means the firm is managing the assets in a portfolio, and therefore, the portfolio should be included in a composite. If a client restricts a portfolio such that the manager cannot carry out the intended strategy, the firm may classify that portfolio as nondiscretionary and, therefore, not include it in a composite.

Verification of GIPS Compliance

Firms are encouraged, but not required, to pursue verification of their compliance with GIPS. Verification applies to the entire firm's performance measurement practices and methods, not a selected composite.

If a firm chooses verification, it must appoint an independent third party to perform it. This third party must attest that the firm has complied with all GIPS requirements on a firmwide basis and has processes in place to present performance in accordance with GIPS.

ETHICS APPLICATION

This reading presents additional examples for each of the Standards of Practice. As with the Code and Standards themselves, we recommend that candidates study this material multiple times from the assigned curriculum. We believe the examples given are a good indicator of the depth at which Level I exam questions will test the Code and Standards.

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[1] Bidhan L. Parmar, PhD, Dorothy C. Kelly, CFA, and David B. Stevens, CFA, "Ethics and Trust in the Investment Profession," CFA Program 2023 Level I Curriculum, Volume 1 (CFA Institute, 2022).

ESSENTIAL EXAM STRATEGIES

The level of review contained in this section is different from our other CFA review materials. As always, our objective is to enhance your chances of passing the CFA exam. Unlike the previous part of this book, which covers *what* you need to know to pass the Level I CFA exam, this section provides you important guidance on *how* to pass the exam. By this time, you have likely studied the entire Level I curriculum and have a solid grasp on the content, so we won't spend any time here reviewing or quizzing you on material you already know. Instead, we provide insights about how to successfully apply your hard-earned knowledge on exam day.

First, we provide some proven approaches to mastering the Level I CFA curriculum. Next, we present a structured plan for the last week before the exam. Following this plan assures that you will be sharp on exam day, and your performance will not be adversely affected by your nerves. We will also spend some time discussing general exam-taking strategies and how to approach individual questions.

A Formidable Task

Over the past few months, you have studied an enormous amount of material. CFA Institute's assigned learning modules for the Level I curriculum include more than 3,000 pages. There are more than 500 learning outcome statements. This is a huge amount of material. Realistically speaking, it is virtually impossible to remember every detail within the curriculum. The good news is you don't have to know every detail. From this guide, you will learn how to get the most benefit from the short time remaining until the exam.

As you prepare for the CFA exam, try to focus on the exam itself. Don't add to your stress level by worrying about whether you'll pass or what might happen if you don't. If you must, you can worry about all of that after the exam. If you worry about it before the exam, or especially during the exam, your performance will likely suffer. There is ample stress in remembering the material, let alone worrying whether you'll pass. Many of the tips we provide are proven stress reducers on exam day. Your grasp of the content, combined with the tips we provide, will have you well prepared for the exam experience.

All of the faculty at Kaplan Schweser have earned CFA charters and have extensive experience in teaching the topics covered in the CFA curriculum. As such, we know what you are going through from our own personal experiences, and we have helped tens of thousands of candidates earn the right to use the CFA designation. We've been there and done that! We know the agony and anxiety you are experiencing. Now, we want to share with you the time-honored strategies that we have personally seen lead to success on the Level I CFA exam.

Let's start with some overall thoughts. There are two basic strategies you should follow in learning the CFA curriculum: Focus on the big picture, and know the main concepts.

The Big Picture

Focusing on the big picture means you should know at least a little about every concept. When we took the exam, some of us were not overly comfortable with debt securities. We just didn't deal with bonds on a regular basis. Still, we knew that we had to learn some of the basics for the exam. For example, even if you don't know the formula for effective duration, at least know that effective duration is a measure of interest rate risk. By remembering some basic information on exam day, you will be able to narrow your answer choices. You probably won't answer many questions correctly with only a basic grasp of the concept, but you can improve your odds on a multiple-choice question from 33% to 50%. You also will be able to better distinguish between the relevant and irrelevant information in a question. Continuing with our duration theme, you would know that bond rating information provided in a duration question is not relevant, since bond ratings reflect credit risk, not interest rate risk.

Even if you don't currently work with, for example, futures, and you know you never will, try to at least get a basic grasp of the important concepts within the topic. It is simply a poor exam strategy to completely blow off significant pieces of the curriculum. We have known people in the CFA program who thought that as long as they knew a few of the assigned topics really well, they could bluff their way through the rest of the exam. These were smart individuals, but they had poor exam strategies. So far, none of them have passed the Level I exam that way.

Know the Main Concepts

It is important to identify those concepts that can be considered core knowledge for a financial analyst. In any given year, some concepts might be emphasized more than others, but if you can answer most of the questions concerning the main concepts, you will dramatically increase your chance of passing. Generally, the idea is to be correct on most of the questions dealing with the core concepts, and then rely on your "big picture" knowledge to get points on the remaining material.

Topic Weighting

In preparing for the exam, you must pay attention to the weights assigned to each topic within the curriculum. The Level I topic weights are as follows:

Topic	Exam Weight	Number of LOS	Points per LOS
Quantitative Methods	8%–12%	81	0.27 to 0.40
Economics	8%–12%	83	0.26 to 0.39
Financial Statement Analysis	13%–17%	107	0.33 to 0.43
Corporate Issuers	8%–12%	40	0.54 to 0.81
Equity Investments	10%–12%	63	0.43 to 0.51
Fixed Income	10%–12%	60	0.45 to 0.54
Derivatives	5%–8%	22	0.61 to 0.98
Alternative Investments	5%–8%	11	1.23 to 1.96
Portfolio Management	5%–8%	55	0.25 to 0.39
Ethical and Professional Standards	15%–20%	21	1.92 to 2.57
Totals	**100%**	**543**	**0.50**

Notice how the LOS counts are not consistent with the exam weights. In fact, some topic areas with a relatively high number of LOS have a relatively low weight on the exam, so allocating your preparation time based on the number of LOS will most likely lead to over-preparation in some areas (e.g., Portfolio Management) and under-preparation in others (especially Ethical and Professional Standards).

Formulas

You may be surprised to know that the Level I CFA examination is quite conceptual and is not heavily weighted toward computations based on memorized formulas. It is nothing like what my undergraduate students used to refer to as “plug and chug” problems. Certainly, some formulas are required, but you will find that you need to use your calculator much less often than you might imagine after reading the required material. Examples of the types of formulas that you need to commit to memory are the constant growth dividend discount model, the security market line, the correlation coefficient, and both the traditional and expanded DuPont formulas for decomposing ROE.

Many times you will be given questions where the answer can be obtained by using a formula and a fairly lengthy calculation but where you can also identify the correct answer without calculation, if you truly understand the concept or relationship being tested. With any formula you encounter in the required readings, you should try to gain a clear understanding of what it is telling you (when it is appropriate to use it) and of the relationship among the various input variables.

One example of this sort of understanding is the holding period return or holding period yield. It is simply the percentage increase in the value of an investment over the holding period. If you buy a stock for $100, receive a $5 dividend, and sell it for $103 at the end of the period, the value increased from $100 to $108, an increase of 8% (which is the holding period return or yield). If you understand that the harmonic mean is used to get the average price per share when the same amount is invested over multiple periods, you can

easily calculate the harmonic mean of $1, $2, and $3. If you invested a total of $6 at each of these three prices, you would buy 6/1 + 6/2 + 6/3 = 11 shares and spend a total of $6 × 3 = $18. The average price per share (and the harmonic mean) is 18/11 = $1.636.

Think of the formula as just a shorthand way of expressing a relation or concept you need to understand. For example, the formula tells you that the population variance is the average squared deviation from the mean. Approaching formulas in this way will reduce your chances of missing a problem because your memory fails you under the stress of the exam. I can never remember the formula for an updated probability using Bayes' Theorem, but ever since I understood it as presented in a tree diagram, I can calculate updated probabilities without a problem and without worrying whether I "remembered" the precise formula correctly.

"Characteristic" Lists

Another common source of specific questions is identifying the characteristics of various securities, models, and valuation methods. A typical question format would be "Which of the following most accurately describes…?" Here, the big-picture approach can help you weed out wrong answers. Also, some candidates use mnemonics to help them remember lists of characteristics or lists of pros and cons.

Acronyms

Exam questions may include common abbreviations and acronyms that appear in the Level I curriculum. You should be able to recognize all the abbreviations in the following list:

Abbreviation	Full name
CAPM	Capital Asset Pricing Model
D/E	Debt-to-equity ratio
EBIT	Earnings before interest and taxes
EBITDA	Earnings before interest, taxes, depreciation, and amortization
EPS	Earnings per share
ETF	Exchange Traded Funds
FIFO	First-in, first-out
IFRS	International Financial Reporting Standards
IPO	Initial public offering
IRR	Internal rate of return
LIFO	Last-in, first-out
NAV	Net asset value
NPV	Net present value
P/B	Price-to-book ratio
P/CF	Price-to-cash-flow ratio
P/E	Price-to-earnings ratio
PPE or PP&E	Property, plant, and equipment
ROA	Return on assets
ROE	Return on equity
U.S. GAAP	U.S. Generally Accepted Accounting Principles
WACC	Weighted average cost of capital

Know Your Strengths

We each have our own style of learning. Some of us can sit down and study for hours at a time, while some of us learn better in small doses each day. Be aware of your study habits, and do not place unrealistic burdens on yourself. Be especially aware of problems with certain topics. For example, if you have always struggled with accounting, look at ways to improve your grasp of the accounting material—spend more time with it, attend a review course, or join a study group. *Do not* expect that you can ignore a topic and make up for the lost points by excelling in another area. Similarly, do not skip an area just because you think you already know it. There are CPAs who fail the accounting section and PhDs in Economics who fail the economics section. You need to review the specific material in the assigned CFA curriculum to pass the CFA exam.

The Rules

At some point in your studies, it would be a good idea to review the Testing Policies section of the CFA Institute web site. Believe it or not, you will probably find this to be a nice break from accounting or derivatives! Be sure that you have a passport that will not expire before

exam day. Select an approved calculator and learn how to use it proficiently. You should also read the CFA Program Errata that are issued in the months before the exam.

Be aware of items you can and cannot take to the exam. CFA Institute strictly prohibits taking any of the following into the testing room:

- Food or drinks.
- Wallets or purses.
- Watches or timers.
- Jewelry other than wedding or engagement rings.
- Backpacks, briefcases, luggage of any kind.
- *Any* study materials.
- Scratch paper, pens and pencils, calculator manuals.
- Cell phones, any personal electronics.

Do not expect that these policies do not apply to you. Every year numerous candidates have problems on exam day because they assumed their cases would be legitimate exceptions. There is no such thing. We have stories of people sprinting back to their cars to put stuff away and get back in time to start the exam. If you read the rules and follow them, you reduce the potential for unexpected stress on your exam day. That's a good thing!

Final Preparation—The Week Before Your Exam

Have a well-defined strategy for the last week before your exam. If at all possible, it is best to take at least some leave from your job. You should save at least one mock exam for the last week. To simulate the real exam, you should avoid looking at this exam or studying questions from it until you are ready to sit down and take it for the first time. Take this exam early in the final week. Take the first half of the exam in a 2 hour and 15 minute period, take a 30-minute break, then take the other half in a second 2 hour and 15 minute period. Time yourself so you can get a feel for the time constraints and pressure of exam day. Remember, you have an average of 90 seconds per question. When you have completed the entire exam, use these results to identify areas where you need to focus your study efforts over the last few days. You should devote most of your time to areas where you performed poorly, but you should also spend enough time keeping your stronger topics fresh in your mind.

At some point during the week before your exam, it is a good idea to visit the actual exam center. Figure out how long it will take to get to your test center and where you can park. Taking a light snack can make your break more relaxing. If your exam appointment is on a Saturday or Sunday and you are relying on public transportation, make sure to confirm the weekend schedule. The fewer surprises and distractions on exam day, the better.

On the day before your exam we recommend rereading Ethical and Professional Standards, including all the examples, from the curriculum volume.

Exam Windows and Computer-Based Testing

CFA Institute offers the Level I exam four times per year, in February, May, August, and November. Each exam is available over a period of up to one week. Registration deadlines

are set such that a candidate who needs to retake the Level I exam must wait at least six months between attempts. That is, a candidate may attempt the Level I exam a maximum of two times in a calendar year.

The Level I exam is computer-based and given at Prometric exam centers. You are responsible for scheduling an appointment to take your exam at one of these centers.

We recommend that you use the Prometric exam software tutorial to get comfortable with the user interface you will encounter when you sit for the exam. A link to the tutorial can be found at https://www.prometric.com/test-takers/search/cfa.

No scratch paper is allowed, but each candidate will be provided with an erasable whiteboard and marker to use during the exam.

An exam appointment is up to 5½ hours. In the first half hour, you will read and electronically sign the candidate pledge and may review the software tutorial. You will then have 2 hours and 15 minutes to complete the first half of the exam (90 questions, 1½ minutes per question on average). You may take a 30 minute break before you start the second half of the exam, which is also 90 questions in 2 hours and 15 minutes.

Different Topic Areas in Each Session

The first 2½ hour session begins with a section on Ethical and Professional Standards, followed by a section on the Investment Tools topic areas of Quantitative Methods, Economics, and Financial Statement Analysis. Within the Investment Tools section, questions will not be grouped by topic area; you might see individual questions from these three topic areas appear in any order.

The exam software does not require you to answer the questions in sequence from 1 to 90. If you find that Ethics questions take you longer to answer than the rest, you can bank some time by starting with the Investment Tools section and then coming back to Ethics. Note, however, that you must complete the first session before the break and cannot come back to it during the second session.

The second exam session begins with a section that tests Corporate Issuers and Portfolio Management, followed by a section that tests the Investment Assets topic areas of Equity Investments, Fixed Income, Derivatives, and Alternative Investments. Within each of these two sections the questions will again be mixed by topic area.

Exam Day

Answering Level I Multiple-Choice Questions

Read the full question carefully! Watch for double negatives like “Which of the following is least likely a disadvantage...” It is very important not to miss words, or parts of words, by reading too quickly (e.g., reading “most likely” instead of “least likely,” or “advantages” instead of “disadvantages”).

For non-numerical questions, read *all* answer choices. Don’t just stop when you get to one that sounds right. There may be a better choice.

For long questions, dissect the bits of information that are provided. What information is relevant? What is most specifically related to the question? Often a wrong answer looks

good because it is consistent with information in the question that is actually irrelevant.

After you read the question, determine what you think the question is asking. This can help you filter out extraneous information and focus quickly on appropriate answer choices.

Similarly, after you read the question, it is a good idea to formulate your own answer before reading the answer choices. Develop an expectation of what the answer should be. This may make the correct answer sound better to you when you read it.

On calculation problems, after you have selected an answer choice, pause for a moment and think about whether the answer makes sense. Is the sign of the result correct, or does the direction of change make sense?

Do not look for patterns in answers. Just because the last three questions all had "C" for an answer, do not expect the next answer not to be "C." There is no reason to expect that CFA Institute has a preference for how many questions are answered with the same letter.

Trust your first impressions. You will find that you are often correct. It is okay to change an answer, but only do so if you have a *good* reason. Over the years, we have heard many stories of how candidates talk themselves out of the correct answer. We have all done this. If you come back to a question, be sure you can justify any change before you make it.

Finally, and probably *most* importantly, *do not lose confidence*. No one has ever received a perfect score on a CFA exam. It just does not happen. You can miss a significant number of questions and still pass. Even if you have struggled on a few questions, maybe even five or six in a row, do not lose confidence. The worst thing you can do is second-guess yourself—you will take longer on every question and start changing correct answers.

What To Do With a Difficult Question

There will undoubtedly be questions that give you trouble. You might not understand the question, may think that none of the answers make sense, or simply may not know the concept being tested. The following tips will likely prove to be useful if you find yourself facing a difficult question.

- If the question does not make sense or if none of the answers look remotely correct, reread the question to see if you missed something. If you are still unsure, select an answer choice and move on. Don't agonize over it and waste precious time that can be allocated to questions you can nail.
- *Never leave an answer blank*. A blank answer has a maximum point value of zero. A randomly marked answer has an expected value of $0.33 \times 1.5 = 0.5$ points, and if you can eliminate one bad answer, this value increases to $0.5 \times 1.5 = 0.75$. You are not penalized for wrong answers.
- If you are unable to determine the "best" answer, you still should be able to help your odds. Try to eliminate one answer choice and then just guess.
- Take some comfort in the fact that the CFA exams are graded on a curve. If a question gave you trouble, it is quite possible that it was troublesome for many other candidates as well.

Time Management

Candidates who fail to pass CFA exams cite time management as their biggest downfall. Do not let poor time management determine your exam results. The following are some tips to help you manage your time wisely.

Take at least one practice exam where you time yourself. This will give you some indication of whether you will have problems on exam day. However, do not let your positive results on practice exams lull you into overconfidence. The stress of exam day, plus possible distractions like noise or a cold exam room, can make a big difference in how fast you work.

Monitor your progress. Keep an eye on the time as you work through the exam. There will be 90 questions in each 2 hour and 15 minute exam session, which means 40 questions per hour or 10 questions every 15 minutes. You may deviate some as you work through easier or more difficult questions, but be careful not to let yourself fall too far behind.

Never panic! Even if you fall behind, panicking will only make things worse. You won't think clearly and you'll miss easy questions. If you need a short break, take a few deep breaths. The 30 seconds or so that this takes may very well help you think clearly enough to answer several additional questions correctly.

Catch your breath at the break. If you eat something, eat light; avoid heavy foods that can make you feel drowsy during the second session.

If you talk to other candidates during your break, do not let their comments influence you. They may say the exam is easier or more difficult than they expected, but they might not be correct about how well they are doing. If you want, you can review a little at the break. That's fine. But if you need to relax for a few minutes, that may do you just as much good as an additional 30-minute cram session. Do what you are most comfortable with.

Question Formats at Level I

Here are some guidelines CFA Institute adheres to in constructing questions for the Level I exam:

- Each question draws on one or more Learning Outcome Statements.
- Terminology and symbols will be consistent with those used in the readings (and, therefore, the SchweserNotes).
- Candidates do not need to know the numbers for specific Standards of Practice.
- Empirical results cited in the readings are not tested.
- The exam does not reuse old questions. All questions are new.
- Distractors (the incorrect choices) are written to capture the most common mistakes a candidate is likely to make on a question.
- Each question has three answer choices.
- "None of the above," "all of the above," and "not enough information" are not used.
- The words "true," "false," and "except" do not appear in the question stems. Instead, the questions use phrases like "most accurate," "least likely," or "closest to."
- Every question has its own stem and answer choices. The Level I exam does not have any multiple-part questions.
- Written answer choices are arranged from shortest to longest.

- Numeric answer choices are arranged from lowest to highest.

As to the format of Level I questions, you can expect two main varieties.

1. Sentence completion with three choices, such as the following: When yields increase, bond prices:
   a. fall.
   b. rise.
   c. are unaffected.
2. A complete question with three answer choices: If a central bank decreases its policy rate by 1% and nominal long-term interest rates increase, which of the following is the *most likely* reason?
   a. The central bank also increased its target for long-term rates.
   b. Changes in long-term rates always are opposite to changes in the policy rate.
   c. The expansionary monetary policy action caused an increase in expected future inflation.

Specific Types of Questions You Should Expect

It is very difficult to generalize Level I questions. Some are straightforward, some look straightforward but have a trick to them, and some are just confusing. CFA Institute's objective is to evaluate your grasp of the Level I Candidate Body of Knowledge. They do not set out to confuse or frustrate you, although that *is* a common result.

Following are some general types of questions and answers to expect.

Cause and Effect Problems

Part of the reason Level I CFA questions seem so difficult is because they ask you to apply your knowledge in ways you may not expect. Many questions combine more than one LOS or ask you to reason out the results and implications of a given series of events. These questions require some thought and will definitely be more difficult if you are not well-rested, or if you are stressed out.

Long Questions

Look out for these. They are major time-burners. The worst areas are Ethics and Financial Reporting and Analysis. In both areas, you get a lot of irrelevant information, so try to weed out the confusion factors and focus on what's important. It often helps to *read the end of the question first* and then know what information is relevant as you read the body of the question.

Tempting but Unnecessary Calculations

CFA Institute is interested in testing your grasp of the Level I curriculum. They are not particularly interested in whether or not you can use your calculator. CFA Institute has always emphasized the qualitative grasp of a concept over the quantitative "number crunching" type question. Even so, you might see questions that appear to call for long, complex calculations. Before you start wearing down your calculator battery, spend a moment to see if there is a short cut. Here is a question on debt securities to emphasize this point.

1. Given the spot rates in the table, the 1-year forward rate two years from now is:

Time (years)	Annual Spot Rate
1	15.0%
2	12.5%
3	10.0%
4	7.5%

A. –3.21%

B. 5.17%

C. 10.00%

The correct answer is B. This is an example of a calculation question where you can look at the answer choices and reason out a correct answer without doing any calculations. Think about this question for a moment. The spot yield curve is declining. The one-year rate two years from now will have to be a rate such that after earning 12.5% for two years, you will end up with an average return over three years of 10%. The answer has to be less than 10%, right? A spot rate between two positive spot rates is very unlikely to be negative, and B is the only choice less than 10%. If you want to do the calculation, it is:

$$\frac{(1+S_3)^3}{(1+S_2)^2}-1=2y1y;\frac{(1+0.10)^3}{(1+0.125)^2}-1=2y1y;\ 2y1y=5.17\%$$

This question is an example of how taking a few seconds and applying some big picture understanding can actually save you some time. Also, if you did the calculation, you could use the preceding logic to check yourself.

2. An annual-pay three-year note with an 8% coupon has a yield to maturity of 8%. An analyst's pricing model forecasts that if the benchmark yield curve shifts up by 50 basis points, the bond's price will decrease to 98.75, and if the benchmark curve shifts down by 50 basis points, the bond's price will increase to 100.25. The bond's effective convexity is *closest* to:

   A. –400.

   B. 30.

   C. 240.

   The correct answer is A. At first glance, this looks like a calculation that requires the formula for effective convexity. But step back for a moment and look at the information given. With an 8% coupon and an 8% yield to maturity, the bond's price equals par value. For equal-sized changes in the benchmark curve, the estimated price increase is less than the estimated price decrease. This is opposite what we would expect for a bond that has positive convexity. This bond must have negative convexity and choice A is the only answer that is negative.

   If you prefer, you can do the calculation:

$$\text{effective convexity}=\frac{V_-+V_+-2V_0}{(\Delta\text{curve})^2V_0}=\frac{100.25+98.75-2(100)}{(0.005)^2(100)}=-400$$

Indirect or Confusing Wording

Despite what you might hear from other candidates, we honestly don't think CFA Institute purposely writes confusing questions. It is more likely that a particular question is trying to

approach a concept from an unusual perspective. That is a good way to test your grasp of a concept, but sometimes the wording makes it difficult to figure out what is being tested. If you get confused by a question, think it through but don't waste too much time on it. Remember, you are probably not the only one scratching your head.

"Distractor" Answers That Are True But Not Correct

These are answer choices that seem like good answers for any of several reasons:

- They might be true, but not appropriate answers (or at least not the best answer).
- They might be consistent with irrelevant information provided in the question.
- They might include "buzzwords" or common misconceptions about a concept.

Be very careful with these types of distractors because they may make sense even though they are wrong. They may also make you think you could defend them as an answer choice. You might think, "Well, they want me to answer 'A,' but I think 'B' is okay and I can argue the point with anyone." Think again—you will never get to argue the point. Instead, select the *best* answer that is true all of the time and applies in every case, not the one you think could work.

Answer Choices That Can Be Eliminated

We have stressed the importance of reading every answer choice before making your selection. This strategy will help you avoid missing a better answer. Similarly, when you are struggling with a question, eliminate the worst answer to narrow your choices and improve your odds of earning some points.

INDEX

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

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