

Book 1: Quantitative Methods, Economics, and Corporate Finance

SchweserNotes™ 2027

Level I CFA®

KAPLAN  **SCHWESER**

SCHWESERNOTES™ 2027 LEVEL I CFA® BOOK 1: QUANTITATIVE METHODS, ECONOMICS, AND
CORPORATE FINANCE

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LEARNING OUTCOME STATEMENTS (LOS)

1. Returns of Financial Assets and Instruments

The candidate should be able to:

- a. describe, compare, and interpret returns. (page 1)
- b. describe, compare, and interpret required rates of return, risk-free rates, risk premia, and inflation. (page 7)

2. Types of Financial Returns

The candidate should be able to:

- a. calculate, compare, and interpret different types of returns for financial assets, instruments, and indicators. (page 15)

3. Benchmarking Returns

The candidate should be able to:

- a. calculate and compare money-weighted and time-weighted rates of return. (page 27)
- b. describe the choices and the implications of the different weighting methods used in index construction and management, and calculate, interpret, and explain the value and the returns of an index. (page 32)

4. The Time Value of Money in Finance

The candidate should be able to:

- a. calculate and interpret the present value of fixed-income and equity instruments based on expected future cash flows. (page 50)
- b. calculate and interpret the implied return of fixed-income instruments and required return and implied growth of equity instruments given their present value and cash flows. (page 56)
- c. explain the cash flow additivity principle and its importance for the condition of no arbitrage, and explain its use in calculating implied forward interest rates, forward exchange rates, and option values. (page 58)

5. Statistical Characteristics of Asset Returns

The candidate should be able to:

- a. calculate, interpret, and evaluate various measures of (1) central tendency and location and (2) dispersion. (page 67)
- b. describe, interpret, and evaluate measures of skewness and kurtosis. (page 74)
- c. calculate, interpret, and evaluate covariance and correlation. (page 78)
- d. calculate, interpret, and evaluate semi-deviation and coefficient of variation. (page 81)

6. Statistical Distributions for Financial Asset Prices and Returns

The candidate should be able to:

- a. calculate, interpret, and evaluate unconditional expected values for mean, variance, and covariance. (page 89)
- b. calculate, interpret, and evaluate the principal moments of key statistical distributions used in finance. (page 94)
- c. calculate, interpret, and evaluate conditional expectations, variances, and covariances. (page 105)
- d. formulate investment problems through Bayesian updating. (page 108)

7. Estimation and Hypothesis Testing

The candidate should be able to:

- a. explain the central limit theorem and the application of confidence intervals and sampling methodologies. (page 115)
- b. explain hypothesis testing and its components, including statistical significance, Type I and Type II errors, and the power of a test; construct appropriate hypothesis tests; and interpret the results. (page 124)
- c. compare and contrast parametric and non-parametric tests, describe situations in which each is the more appropriate type of test, construct appropriate hypothesis tests, and interpret the results. (page 144)

8. The Return and Risk of a Financial Portfolio

The candidate should be able to:

- a. calculate, interpret, and evaluate the expected return, variance, standard deviation, covariance, and correlation of portfolio returns. (page 156)
- b. describe, calculate, and interpret the minimum-variance portfolio and portfolios that lie on the efficient frontier. (page 167)
- c. explain the selection of an optimal portfolio, given an investor's risk aversion and the capital allocation line, and how this extends to the market portfolio and the capital market line. (page 172)

9. Simulation of Financial Asset Prices and Returns

The candidate should be able to:

- a. describe historical simulation and explain how it can be used in investment applications. (page 191)
- b. describe bootstrap resampling, and explain how it can be used in investment applications. (page 194)
- c. describe Monte Carlo simulation and explain how it can be used in investment applications. (page 197)

10. Applications of Simple Linear Regression in Finance

The candidate should be able to:

- a. describe, interpret, and explain simple linear regression, including coefficient estimation using the least squares criterion. (page 203)
- b. describe and compare the assumptions of simple linear regression, identify violations through analyzing residuals, evaluate the estimated model's goodness-of-fit and regression coefficients, and results of ANOVA estimates. (page 208)
- c. calculate and interpret predicted values, the standard error of the estimate, and prediction intervals for the dependent variable in a simple linear regression model and describe different functional forms. (page 217)
- d. calculate and interpret the variable estimates of the capital asset pricing model (CAPM). (page 221)

11. Introduction to Financial Data Science

The candidate should be able to:

- a. describe how big data, machine learning, and artificial intelligence are used in financial data science, fintech, and investment management. (page 229)

12. The Firm and Market Structures

The candidate should be able to:

- a. determine and interpret breakeven and shutdown points of production, as well as how economies and diseconomies of scale affect costs under perfect and imperfect competition. (page 241)
- b. describe characteristics of perfect competition, monopolistic competition, oligopoly, and pure monopoly. (page 246)
- c. explain supply and demand relationships under monopolistic competition, including the optimal price and output for firms as well as pricing strategy. (page 248)
- d. explain supply and demand relationships under oligopoly, including the optimal price and output for firms as well as pricing strategy. (page 250)
- e. identify the type of market structure within which a firm operates and describe the use and limitations of concentration measures. (page 256)

13. Understanding Business Cycles

The candidate should be able to:

- a. describe the business cycle and its phases. (page 265)
- b. describe credit cycles. (page 266)
- c. describe how resource use, consumer and business activity, housing sector activity, and external trade sector activity vary over the business cycle and describe their measurement using economic indicators. (page 267)

14. Fiscal Policy

The candidate should be able to:

- a. compare monetary and fiscal policy. (page 275)
- b. describe roles and objectives of fiscal policy as well as arguments as to whether the size of a national debt relative to GDP matters. (page 276)
- c. describe tools of fiscal policy, including their advantages and disadvantages. (page 277)
- d. explain the implementation of fiscal policy and difficulties of implementation as well as whether a fiscal policy is expansionary or contractionary. (page 280)

15. Monetary Policy

The candidate should be able to:

- a. describe the roles and objectives of central banks. (page 287)
- b. describe tools used to implement monetary policy tools and the monetary transmission mechanism, and explain the relationships between monetary policy and economic growth, inflation, interest, and exchange rates. (page 288)
- c. describe qualities of effective central banks; contrast their use of inflation, interest rate, and exchange rate targeting in expansionary or contractionary monetary policy; and describe the limitations of monetary policy. (page 291)
- d. explain the interaction of monetary and fiscal policy. (page 294)

16. Introduction to Geopolitics

The candidate should be able to:

- a. describe geopolitics from a cooperation versus competition perspective. (page 299)
- b. describe geopolitics and its relationship with globalization. (page 300)

- c. describe functions and objectives of the international organizations that facilitate trade, including the World Bank, the International Monetary Fund, and the World Trade Organization. (page 302)
- d. describe geopolitical risk. (page 303)
- e. describe tools of geopolitics and their impact on regions and economies. (page 304)
- f. describe the impact of geopolitical risk on investments. (page 304)

17. International Trade

The candidate should be able to:

- a. describe the benefits and costs of international trade. (page 309)
- b. compare types of trade restrictions, such as tariffs, quotas, and export subsidies, and their economic implications. (page 310)
- c. explain motivations for and advantages of trading blocs, common markets, and economic unions. (page 313)

18. Capital Flows and the FX Market

The candidate should be able to:

- a. describe the foreign exchange market, including its functions and participants, distinguish between nominal and real exchange rates, and calculate and interpret the percentage change in a currency relative to another currency. (page 319)
- b. describe exchange rate regimes and explain the effects of exchange rates on countries' international trade and capital flows. (page 324)
- c. describe common objectives of capital restrictions imposed by governments. (page 326)

19. Exchange Rate Calculations

The candidate should be able to:

- a. calculate and interpret currency cross-rates. (page 331)
- b. explain the arbitrage relationship between spot and forward exchange rates and interest rates, calculate a forward rate using points or in percentage terms, and interpret a forward discount or premium. (page 332)

20. Organizational Forms, Corporate Issuer Features, and Ownership

The candidate should be able to:

- a. compare the organizational forms of businesses. (page 341)
- b. describe key features of corporate issuers. (page 342)
- c. compare publicly and privately owned corporate issuers. (page 343)

21. Investors and Other Stakeholders

The candidate should be able to:

- a. compare the financial claims and motivations of lenders and shareholders. (page 349)
- b. describe a company's stakeholder groups and compare their interests. (page 351)
- c. describe environmental, social, and governance factors of corporate issuers considered by investors. (page 353)

22. Corporate Governance: Conflicts, Mechanisms, Risks, and Benefits

The candidate should be able to:

- a. describe the principal-agent relationship and conflicts that may arise between stakeholder groups. (page 357)

- b. describe corporate governance and mechanisms to manage stakeholder relationships and mitigate associated risks. (page 359)
- c. describe potential risks of poor corporate governance and stakeholder management and benefits of effective corporate governance and stakeholder management. (page 362)

23. Working Capital and Liquidity

The candidate should be able to:

- a. explain the cash conversion cycle and compare issuers' cash conversion cycles. (page 367)
- b. explain liquidity and compare issuers' liquidity levels. (page 369)
- c. describe issuers' objectives and compare methods for managing working capital and liquidity. (page 372)

24. Capital Investments and Capital Allocation

The candidate should be able to:

- a. describe types of capital investments. (page 377)
- b. describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation. (page 378)
- c. describe principles of capital allocation and common capital allocation pitfalls. (page 384)
- d. describe types of real options relevant to capital investments. (page 385)

25. Capital Structure

The candidate should be able to:

- a. calculate and interpret the weighted-average cost of capital for a company. (page 391)
- b. explain factors affecting capital structure and the weighted-average cost of capital. (page 392)
- c. explain the Modigliani–Miller propositions regarding capital structure. (page 394)
- d. describe optimal and target capital structures. (page 398)

26. Business Models

The candidate should be able to:

- a. describe key features of business models. (page 405)
- b. describe various types of business models. (page 407)

READING

1

Returns of Financial Assets and Instruments

MODULE 1.1: RATES OF RETURN

LOS 1.a: Describe, compare, and interpret returns.

We can evaluate returns on a financial asset, a financial instrument, or a financial indicator. These categories overlap somewhat, but we can define them as follows:

Financial assets are items investors can own that represent value, and primarily include:

- cash
- equity ownership
- debt, which is an asset of the party to whom a debt is owed
- securities that are hybrids of debt and equity

Financial instruments are standardized means of trading financial assets in markets, and primarily include:

- equity and debt securities
- tradable standardized contracts, such as some derivatives

Financial indicators are observable measures of value that do not generate cash flows, and include:

- interest rates
- currency exchange rates
- market indexes

Returns in a Single Period

The two sources of asset returns are price changes and cash income. We speak of the **price return** (or **capital appreciation return**) as the percentage change in an asset's price between two points in time:

$$r_{\text{price}} = \frac{P_1 - P_0}{P_0}, \text{ where } P_0 \text{ is the beginning price and } P_1 \text{ is the ending price.}$$

The **capital distribution return** is the cash income an asset generates during a period, as a percentage of the asset's beginning price. Examples of capital distribution return we will see later in the Level I curriculum include the **dividend yield** of an equity security and the **current yield** of a fixed income security:

$$r_{\text{distribution}} = \frac{\text{income}}{P_0}$$

Total return on an asset during a period is the sum of its price return and capital distribution return for that period:

$$\begin{aligned} r_{\text{total}} &= r_{\text{price}} + r_{\text{distribution}} \\ &= \frac{P_1 - P_0 + \text{income}}{P_0} \end{aligned}$$



PROFESSOR'S NOTE

We often refer to this as an asset's **holding period return**. As we will see later in this reading, returns are typically stated on an annualized basis rather than on a holding period basis.

EXAMPLE: Price, capital distribution, and total return

A stock is valued at €20 at the beginning of the period, pays €1 in dividends over the period, and at the end of the period is valued at €22. Calculate its price return, capital distribution return, and total return for the period.

Answer:

$$\text{Price return} = \frac{22 - 20}{20} = 10\%$$

$$\text{Capital distribution return} = \frac{1}{20} = 5\%$$

$$\text{Total return} = 10\% + 5\% = 15\%, \text{ or } \frac{22 - 20 + 1}{20} = 15\%$$

A return calculated from known past prices and income is an **actual return**, or **ex post return**. We can also estimate an **expected return**, or **ex ante return**, for a future period. Investors make decisions based on expected returns, but actual returns most often differ from what was expected. The difference between expected returns and actual returns represents the concept of *risk*, which we will address in the next LOS.

Returns based on cash that an investor has received are **realized returns**. These include income received (capital distributions) and the proceeds from selling an investment. We may also speak of the **unrealized return** on an asset that an investor still holds, based on its current market price. The distinction between realized

and unrealized returns is important for tax reasons. With some exceptions, tax authorities generally assess taxes on income in the period an investor receives it, and on price gains in the period when an investor realizes them by selling an asset.

Returns Across Multiple Periods

The **arithmetic mean return** is the simple average of a series of periodic returns:

$$\text{arithmetic mean return} = \frac{(R_1 + R_2 + R_3 + \dots + R_n)}{n}$$

The **geometric mean return**, or **compound average return**, is a compound rate:

$$\text{geometric mean return} = \sqrt[n]{(1 + R_1) \times (1 + R_2) \times (1 + R_3) \times \dots \times (1 + R_n)} - 1$$

EXAMPLE: Arithmetic and geometric mean return

For the last three years, the returns for Acme Corporation common stock have been -9.34%, 23.45%, and 8.92%. Calculate the arithmetic average and compound average rate of return over the three-year period.

Answer:

$$\text{arithmetic mean return} = \frac{-9.34 + 23.45 + 8.92}{3} = 7.68\%$$

geometric mean return

$$\begin{aligned} &= \sqrt[3]{(1 - 0.0934) \times (1 + 0.2345) \times (1 + 0.0892)} - 1 \\ &= \sqrt[3]{0.9066 \times 1.2345 \times 1.0892} - 1 \\ &= \sqrt[3]{1.21903} - 1 \\ &= 1.06825 - 1 = 6.825\% \end{aligned}$$



PROFESSOR'S NOTE

You can get a third root (or other higher-order root) with your calculator as follows:

- On the TI, enter 1.21903 [y^x] 3 [1/x] - 1 [=]
- On the HP, enter 1.21903 [ENTER] 3 [1/x] [y^x] 1 -

Notice in the example that the geometric mean return is less than the arithmetic mean return. The **arithmetic-geometric mean inequality principle** states that the geometric mean is always less than or equal to the arithmetic mean, and the difference increases as the variability of the observations increases. The only time the arithmetic and geometric means are equal is when there is no variability in the observations (i.e., all observations are equal).

An arithmetic mean return assumes the amount invested at the start does not change. However, that amount does change if an investment experiences any price appreciation or depreciation, or has any cash flows. For this reason, an arithmetic mean return can be misleading, as the following example shows.

EXAMPLE: Geometric and arithmetic mean returns

An investment of \$1,000 loses 25% in Period 1 and gains 25% in Period 2. Is the return over both periods more accurately represented by the arithmetic mean return or the geometric mean return?

Answer:

In Period 1, the investment's value decreases to $\$1,000(1 - 0.25) = \750 . In Period 2, its value increases to $\$750(1 + 0.25) = \937.50 .

The arithmetic mean return is $\frac{-25\% + 25\%}{2} = 0\%$. This is misleading because it suggests the investment's value did not change over the two periods.

The geometric mean return is $\sqrt{(1 - 0.25)(1 + 0.25)} - 1 = -3.175\%$. This accurately reflects the actual change in value over the two periods: $\$1,000(1 - 0.03175)(1 + 0.03175) = \937.51 (difference due to rounding).

Compounding Periods and Annualized Returns

Interest rates and market returns are typically stated as **annualized returns**, regardless of the actual length of the period over which they occur. To annualize a return that is realized over a specific number of days, use the following formula:

$$\text{annualized return} = (1 + \text{return during the period})^{365/\text{days}} - 1$$

EXAMPLE: Annualized return, shorter than one year

A saver deposits \$100 into a bank account. After 90 days, the account balance is \$100.75. What is the saver's annualized rate of return?

Answer:

$$\text{return over 90 days} = \frac{100.75}{100} - 1 = 0.0075 = 0.75\%$$

$$\text{annualized return} = (1 + 0.0075)^{365/90} - 1 = 0.0308 = 3.08\%$$

EXAMPLE: Annualized return, longer than one year

An investor buys a 500-day government bill for \$970 and redeems it at maturity for \$1,000. What is the investor's annualized return?

Answer:

$$\text{return over 500 days} = \frac{1000}{970} - 1 = 0.0309 = 3.09\%$$

$$\text{annualized return} = (1 + 0.0309)^{365/500} - 1 = 0.0225 = 2.25\%$$

In our earlier example of arithmetic and geometric means, the geometric mean resulted in an annual rate of return because the holding periods were years. If the holding periods are other than years, the geometric mean is *not* the same as the annual return. The root for the geometric mean is the number of *periods*, while the

root for the annual return is the number of *years* from the start of the first holding period to the end of the last holding period.

EXAMPLE: Geometric mean vs. annual return

For the last four semiannual periods, the 6-month holding period returns on an investment were 2.0%, 0.5%, -1.0%, and 1.5%. Calculate the geometric mean and the annual rate of return.

Answer:

$$\begin{aligned}\text{geometric mean} &= \sqrt[4]{(1 + 0.02)(1 + 0.005)(1 - 0.01)(1 + 0.015)} - 1 \\ &= 0.007435 = 0.7435\%, \text{ which is the geometric mean} \\ &\quad \text{of the six-month holding period returns.}\end{aligned}$$

$$\begin{aligned}\text{annual return} &= \sqrt[2]{(1 + 0.02)(1 + 0.005)(1 - 0.01)(1 + 0.015)} - 1 \\ &= 0.0149 = 1.49\%\end{aligned}$$

The four semiannual periods equal two years, so to get an annual return, we use *two* as the root.

When we know the number of periods in a year (as we do with daily, weekly, monthly, or quarterly periods), we can easily annualize the returns for a period using the following formula:

$$\text{annualized return} = (1 + \text{return during the period})^c - 1$$

where:

c is the number of periods that make up a year.

EXAMPLE: Comparing returns on an annualized basis

An investor observes the following three securities:

- Security A produced a monthly return of 0.5%.
- Security B produced a quarterly (three-month) return of 1.5%.
- Security C produced a semiannual (six-month) return of 3.0%.

Which security produced the highest annualized return?

Answer:

- Security A annualized return = $(1 + 0.005)^{12} - 1 = 0.0617 = 6.17\%$
- Security B annualized return = $(1 + 0.015)^4 - 1 = 0.0614 = 6.14\%$
- Security C annualized return = $(1 + 0.03)^2 - 1 = 0.0609 = 6.09\%$

On an annualized basis, Security A produced the highest return.

While annualizing returns provides us with a consistent standard for comparing the performance of different investments, we must recognize that it assumes returns are repeatable. In the previous example, the annualized return on Security A is based on one month's return of 0.5%. To realize a return of 6.17% over a full year, the security would have to produce the same 0.5% return in each of another 11 months.

Its actual performance is likely to differ—and even if its monthly returns average 0.5%, they are likely to exhibit some variability.

Continuous Compounding

In time value of money calculations (which we will address in more detail in our reading on The Time Value of Money in Finance), more frequent compounding has an impact on future value and present value computations. For example, we can calculate the present value of \$1,000 to be received one year from now using a stated annual interest rate of 6% with a range of compounding periods.

With semiannual compounding:

$$PV = 1,000 \left(1 + \frac{0.06}{2} \right)^{-2} = 942.60$$

With quarterly compounding:

$$PV = 1,000 \left(1 + \frac{0.06}{4} \right)^{-4} = 942.18$$

With monthly compounding:

$$PV = 1,000 \left(1 + \frac{0.06}{12} \right)^{-12} = 941.91$$

With daily compounding:

$$PV = 1,000 \left(1 + \frac{0.06}{365} \right)^{-365} = 941.77$$

The mathematical limit of shortening the compounding period is known as continuous compounding. Given the return for a period, we can use the natural logarithm (ln, or LN on your financial calculator) to state its associated **continuously compounded return** or **logarithmic return**:

$$R_{cc} = \ln(1 + \text{return during the period}) = \ln\left(\frac{\text{ending value}}{\text{beginning value}}\right)$$

EXAMPLE: Calculating continuously compounded returns

A stock was purchased for \$100 and sold one year later for \$120. Calculate the investor's annual rate of return on a continuously compounded basis.

Answer:

$$\ln\left(\frac{120}{100}\right) = 18.232\%$$

If we were given the return (20%) instead, the calculation is this:

$$\ln(1 + 0.20) = 18.232\%$$

A useful property of continuously compounded rates of return is that they are additive for multiple periods. That is, a continuously compounded return from $t = 0$ to $t = 2$ is the sum of the continuously compounded return from $t = 0$ to $t = 1$ and the continuously compounded return from $t = 1$ to $t = 2$.

EXAMPLE: Continuously compounded return over multiple periods

The value of an investment is 1,000 at $t = 0$, 1,150 at $t = 1$, and 1,250 at $t = 2$. Calculate its continuously compounded rates of return for each period and for the time from $t = 0$ to $t = 2$.

Answer:

$$\text{From } t = 0 \text{ to } t = 1: \ln\left(\frac{1,150}{1,000}\right) = 0.13976 = 13.976\%$$

$$\text{From } t = 1 \text{ to } t = 2: \ln\left(\frac{1,250}{1,150}\right) = 0.08338 = 8.338\%$$

$$\text{From } t = 0 \text{ to } t = 2: \ln\left(\frac{1,250}{1,000}\right) = 0.22314 = 22.314\%$$

Or, $13.976\% + 8.338\% = 22.314\%$.



MODULE QUIZ 1.1

1. If an investment loses 3% of its value over 120 days, its annualized return is *closest* to:
 - A. -8.0%.
 - B. -8.5%.
 - C. -9.0%.
2. If a stock's initial price is \$20 and its price increases to \$23, its continuously compounded rate of return is *closest* to:
 - A. 13.64%.
 - B. 13.98%.
 - C. 15.00%.
3. An ex ante return is described *most accurately* as a return:
 - A. expected over a future period.
 - B. realized in a specified past period.
 - C. that would be realized in a year if past performance continues.

MODULE 1.2: COMPONENTS AND MEASURES OF RETURN

LOS 1.b: Describe, compare, and interpret required rates of return, risk-free rates, risk premia, and inflation.

Interest rates measure the time value of money, although risk differences among financial securities lead to differences in their equilibrium interest rates. Equilibrium interest rates are the **required rate of return** for a particular investment, in the sense that the market rate of return is the return that investors and savers require to get them to willingly lend their funds. Interest rates are also referred to as **discount rates** and, in fact, the terms are often used interchangeably. If an individual can borrow funds at an interest rate of 10%, then that individual should discount payments to be made in the future at that rate to get their equivalent value in current dollars or other currencies.

We can also view interest rates as the **opportunity cost** of current consumption. If the market rate of interest on 1-year securities is 5%, earning an additional 5% is the opportunity forgone when current consumption is chosen rather than saving (postponing consumption).

For any asset that has **risk**, or uncertainty about the amount or timing of its future cash flows, the interest rate (investors' required rate of return) will reflect the degree of risk. We can think of an interest rate as consisting of a **risk-free rate** and a **risk premium**.

Risk-Free Rates of Return

The risk-free rate (which we sometimes refer to as the **nominal risk-free rate**) has two components: a real risk-free rate and an expected inflation rate. When we speak of a "real" rate of return, we are referring to an investor's increase in purchasing power (i.e., after adjusting for inflation). The **real risk-free rate** is an interest rate that contains no expectation of inflation and no uncertainty about future cash flows. What the real risk-free rate represents in economic terms is time preference, the degree to which current consumption is preferred to equal future consumption.

Because expected inflation in future periods is not zero, the rates we observe on instruments that are considered free of default risk (e.g., US Treasury bills) are essentially risk-free rates, but not real risk-free rates. Treasury bill rates are nominal risk-free rates because they contain an **inflation premium**.

The relation between nominal and real risk-free rates is as follows:

$$(1 + \text{nominal risk-free rate}) = (1 + \text{real risk-free rate})(1 + \text{expected inflation rate})$$

or,

$$\text{real risk-free rate} = \frac{1 + \text{nominal risk-free rate}}{1 + \text{inflation rate}} - 1$$

Often, including in many parts of the CFA curriculum, this relation is approximated as follows:

$$\text{real risk-free rate} \approx \text{nominal risk-free rate} - \text{expected inflation rate}$$

Risk Premia

Securities may have one or more types of risk. The risk premium includes each type of risk, so each added risk increases the required rate of return. A risk premium in the interest rate on a bond may include (but is not limited to) the following:

- **Default risk premium.** This reflects the risk that a borrower will not make the promised payments in a timely manner.
- **Liquidity risk premium.** This reflects the risk of receiving less than fair value for an investment if it must be sold quickly for cash.
- **Maturity risk premium.** The prices of longer-term bonds are more sensitive to interest rate changes than those of shorter-term bonds. Longer-maturity bonds have more maturity risk than shorter-term bonds and require a maturity risk premium.

Examples of risk premia in the required rate of return on a stock include (but are not limited to) the following:

- **Size risk premium.** This reflects the difference between the returns on large-capitalization stocks and small-capitalization stocks.
- **Value risk premium.** This reflects the difference between the returns on value stocks (those with high ratios of book value to market value) and stocks with lower book-to-market value ratios.

Later in the Level I curriculum, we will discuss and use the concept of a **market risk premium**, which we define as the difference between the return on the “market portfolio” of all risky assets and the return on a risk-free asset.

Common Measures of Return

As we saw with risk-free returns, a **real return** is a nominal return adjusted for inflation. Consider an investor who earns a nominal return of 7% over a year when inflation is 2%. The investor’s approximate real return is simply $7 - 2 = 5\%$. The investor’s exact real return is slightly lower: $1.07 / 1.02 - 1 = 0.049 = 4.9\%$.

A real return measures the increase in an investor’s purchasing power—how much more goods she can purchase at the end of one year due to the increase in the value of her investments. If she invests \$1,000 and earns a nominal return of 7%, she will have \$1,070 at the end of the year. If the price of the goods she consumes has increased 2%, from \$1.00 to \$1.02 per unit, she will be able to consume $1,070 / 1.02 = 1,049$ units. She has given up consuming 1,000 units today, but instead, she is able to purchase 1,049 units at the end of one year. Her purchasing power has gone up 4.9%; this is her real return.

We often speak of an investment’s **excess return**, which is how much more (or less) it earns compared to a benchmark or a reference rate. For example, if the chosen benchmark (such as the nominal risk-free rate) is 3%, and an investment earns 8%, we can approximate its excess return as $8\% - 3\% = 5\%$. More exactly, its excess return is $1.08 / 1.03 - 1 = 4.85\%$.

Gross return refers to the total return on a security portfolio before deducting fees for the management and administration of the investment account. **Net return** refers to the return after these fees have been deducted. Both gross and net returns deduct commissions on trades and other costs that are necessary to generate the investment returns.

$$\text{gross return} = \text{total return} - \text{transaction costs}$$

$$\text{net return} = \text{gross return} - \text{management fees and administrative costs}$$

Pretax nominal return refers to the return before paying taxes. **After-tax nominal return** refers to the return after the tax liability is deducted. Tax rates on investments differ and may be affected by tax laws where the investment is made as well as those in the investor’s home jurisdiction. Dividend income, interest income, short-term capital gains, and long-term capital gains may all be taxed at different rates. Many countries tax long-term capital gains at lower rates than short-term capital gains. Investors typically can use capital losses on some investments to offset capital gains

on other investments for tax purposes. Capital gains are usually not taxed until the period when the investor realizes the gains.

Assuming a jurisdiction has one tax rate for capital gains and another single tax rate for capital distributions like interest and dividends, we can express the after-tax nominal rate of return as follows:

$$\text{after-tax return} = (\text{price return})(1 - \text{capital gains tax rate}) + (\text{capital distribution return})(1 - \text{capital distribution tax rate})$$

EXAMPLE: Pretax and after-tax nominal returns

An investor buys a stock for \$160 at the beginning of the year and sells it for \$200 at the end of the year. The stock paid \$8 in dividends during the year. The investor is subject to tax rates of 25% on capital gains and 40% on capital distributions. Calculate the investor's pretax and after-tax nominal rates of return.

Answer:

$$\text{Price return} = (\$200 - \$160) / \$160 = 25\%$$

$$\text{Capital distribution return} = \$8 / \$160 = 5\%$$

$$\text{The pretax return is } 25\% + 5\% = 30\%.$$

$$\text{The after-tax return is } 25\%(1 - 0.25) + 5\%(1 - 0.40) = 21.75\%.$$

In finance, *leverage* refers to using borrowed funds or derivatives to increase the amount of an asset an investor can control. A **leveraged return** refers to a return to an investor that is a multiple of the return on the underlying asset. The leveraged return is calculated as the gain or loss on the investment as a percentage of an investor's cash investment.

To illustrate the effect of leverage on returns, consider a fund that can invest the amount V_E in a portfolio without leverage, and earn the rate of return r_P on that portfolio. The fund's unleveraged return (as a money amount) is simply $r_P \times V_E$. Now, let's say this fund can borrow the amount V_D at an interest rate of r_D , and can still earn r_P by investing the proceeds. The fund's leveraged return (again as a money amount), after subtracting the interest cost, then becomes $r_P \times (V_E + V_D) - (r_D \times V_D)$.

Thus, stated as a rate of return on the initial value of V_E , the leveraged rate of return is as follows:

$$\text{leveraged return} = \frac{r_P(V_D + V_E) - r_D V_D}{V_E}$$

EXAMPLE: Effect of leverage on a positive return

Mammoth Fund can earn an 8% return on an unleveraged portfolio of \$800 million. The fund can borrow up to \$200 million at a 5% interest rate. Calculate the fund's leveraged return if it borrows and invests this amount.

Answer:

$$\begin{aligned}\text{leveraged return} &= \frac{r_P(V_D + V_E) - r_D V_D}{V_E} \\ &= \frac{0.08(\$200 \text{ million} + \$800 \text{ million}) - 0.05(\$200 \text{ million})}{\$800 \text{ million}} = 8.75\%\end{aligned}$$

Using leverage increased the fund's rate of return from 8% to 8.75%.

EXAMPLE: Effect of leverage on a negative return

Continuing the previous example, calculate Mammoth Fund's leveraged return if it experienced a loss of 4% on its investment portfolio.

Answer:

$$\begin{aligned}\text{leveraged return} &= \frac{-0.04(\$200 \text{ million} + \$800 \text{ million}) - 0.05(\$200 \text{ million})}{\$800 \text{ million}} \\ &= -6.25\%\end{aligned}$$

Using leverage decreased the fund's rate of return from -4% to -6.25%.

These examples highlight the key point investment managers must understand about leverage: *It magnifies gains, but it also magnifies losses.*

An investment in a derivative security, such as a futures contract or an option, produces a leveraged return because the cash deposited is only a fraction of the value of the assets underlying the derivative.



MODULE QUIZ 1.2

1. An interest rate is *best* interpreted as a:
 - A. discount rate or a measure of risk.
 - B. measure of risk or a required rate of return.
 - C. required rate of return or the opportunity cost of consumption.
2. An interest rate from which the inflation premium has been subtracted is *most accurately* described as a:
 - A. real interest rate.
 - B. risk-free interest rate.
 - C. real risk-free interest rate.
3. The value of an investment increases 5% before commissions and fees. This 5% increase represents:
 - A. the investment's net return.
 - B. the investment's gross return.
 - C. neither the investment's net return nor its gross return.

KEY CONCEPTS

LOS 1.a

Total return = price return + capital distribution return.

Price return = $\frac{P_1 - P_0}{P_0}$, where P_0 is the beginning price and P_1 is the ending price.

Capital distribution return = $\frac{\text{income}}{P_0}$.

Actual return or ex-post return is calculated from actual past prices and income.

Expected return or ex-ante return is an estimated future return.

Realized returns are based on cash an investor has received. Unrealized returns are based on the market prices of assets an investor still owns.

$$\text{arithmetic mean return} = \frac{(R_1 + R_2 + R_3 + \dots + R_n)}{n}$$

$$\text{geometric mean return} = \sqrt[n]{(1 + R_1) \times (1 + R_2) \times (1 + R_3) \times \dots \times (1 + R_n)} - 1$$

The geometric mean is less than the arithmetic mean, as long as there is any variability in the observed returns.

For returns over any number of days:

$$\text{annualized return} = (1 + \text{return during the period})^{365/\text{days}} - 1$$

For returns over a period, when c is the number of periods that make up a year:

$$\text{annualized return} = (1 + \text{return during the period})^c - 1$$

Continuously compounded return:

$$r_{cc} = \ln(1 + \text{return during the period}) = \ln\left(\frac{\text{ending value}}{\text{beginning value}}\right)$$

LOS 1.b

The required rate of return for a particular investment is the return that investors and savers require to get them to willingly lend their funds. We can also view interest rates as the opportunity cost of current consumption.

An interest rate or required rate of return for a risky asset consists of a risk-free rate and a risk premium.

The real risk-free rate contains no expectation of inflation and zero probability of default. A nominal risk-free rate includes an inflation premium, but no risk premium.

$$\text{real risk-free rate} = \frac{1 + \text{nominal risk-free rate}}{1 + \text{inflation rate}} - 1$$

Or, approximately, real risk-free rate $\approx$ nominal risk-free rate – expected inflation rate.

Examples of risk premia for bonds include default risk, liquidity risk, and maturity risk. Examples of risk premia for stocks include size risk and value risk.

Real return is a nominal return adjusted for inflation.

Excess return is the difference between an investment's rate of return and that of a chosen benchmark.

Gross return is total return after deducting transaction costs, but before deducting management and administration fees. Net return is the return after these fees have been deducted.

Pretax nominal return is the return before paying taxes. After-tax nominal return is the return net of tax liability.

Leverage magnifies both gains and losses on investments.

Leveraged return = $\frac{r_P(V_D + V_E) - r_D V_D}{V_E}$, where r_P is the unleveraged return, V_E is the amount invested without leverage, r_D is the interest rate on borrowed funds, and V_D is the amount borrowed.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 1.1

1. C Annualized return = $(1 - 0.03)^{\frac{365}{120}} - 1 = -0.0885 = -8.85\%$.
(LOS 1.a)
2. B $\ln\left(\frac{23}{20}\right) = 0.1398 = 13.98\%$.
(LOS 1.a)
3. A An ex ante return is an expected return. A return realized in a past period is an ex post return. An annualized return is one that would be realized in a year if an investment's past performance continued over the year. (LOS 1.a)

Module Quiz 1.2

1. C Interest rates can be interpreted as required rates of return, discount rates, or opportunity costs of current consumption. A risk premium can be, but is not always, a component of an interest rate. (LOS 1.b)
2. A Real interest rates are those that have been adjusted for inflation. Inflation has been subtracted, but this does not mean the interest rate is risk-free. (LOS 1.b)
3. C Gross return is the total return after deducting commissions on trades and other costs necessary to generate the returns, but before deducting fees for the management and administration of the investment account. Net return is the return after management and administration fees have been deducted. (LOS 1.b)

READING

2

Types of Financial Returns

MODULE 2.1: FINANCIAL ASSETS, INSTRUMENTS, AND INDICATORS



PROFESSOR'S NOTE

In this reading, we discuss the types of financial returns earned by the major types of financial instruments used in investment portfolios. These instruments, such as equities, bonds, and derivatives, are only informally introduced here; each will have its own topic area later where we will discuss them in much more detail. For now, focus on how different financial instruments have different components of returns, and on how this affects an investment manager's decisions.

LOS 2.a: Calculate, compare, and interpret different types of returns for financial assets, instruments, and indicators.

Types of Return

As discussed in the previous reading, investors earn returns from two major sources:

1. **Price return (or capital appreciation return)** comes from a change in the value of the investment.
2. **Capital distribution return** comes from the income that an investment periodically pays. This can be *fixed*, where the rate is stated at the outset, or *variable*, where the rate is uncertain (e.g., when it is linked to prevailing interest rates at the time a particular capital distribution is made).

The **total return** from an investment is the sum of its price return and capital distribution return.

Types of Financial Instruments

The main types of financial instruments are equities, bonds, and derivatives.

- **Equities** (also referred to as *stocks* or *shares*) represent an ownership stake in the issuer of the securities, usually a corporation. The largest component of equity return is price return, driven by changes in the factors that affect the company's earnings. These factors can be company-specific, such as a new product launch, or broader market factors that affect all stocks, such as economic growth. Equity issuers may make **variable capital distributions** in the form of discretionary dividend payments.
- **Bonds** (also referred to as *fixed income* or *debt securities*) are tradable debt instruments. A bondholder is a lender who is typically promised a series of regular fixed interest payments over the bond's life (referred to as *coupons*), and a repayment of the loan balance, (referred to as a bond's *principal*, *par value*, or *face value*), typically at the end of the bond's life (referred to as its *maturity*). The largest component of a bond's return is usually the coupon payment, which is a **fixed capital distribution**. However, a bond's market value can change during its life, leading to price return.
- **Derivatives** are financial instruments that derive their value from the performance of a specified reference asset. For example, a derivative might lock in a price at which two parties will exchange a specific amount of gold on a specific date in the future. This contract will be profitable to the buyer if gold increases in price, while the seller of the contract would suffer a loss.

Cash (notes, coins, and non-interest-bearing deposits) is considered a financial asset that provides no return. **Hybrid financial assets** also exist that offer returns and risks that are a blend of equity and debt, such as a bond that the holder can convert into equity shares of the issuer.

Types of Financial Indicators

Financial indicators are metrics that can affect financial returns, but do not generate cash flows directly themselves. Examples include interest rates, foreign exchange rates, and market indexes.

Interest rates, paid to savers when they lend funds, are observed most explicitly when banks quote rates on interest-bearing deposits. In capital markets, interest rates are observed through the returns offered by securities issued by borrowers in the fixed income market.

An important interest rate is the rate of return offered on short-term government securities. For a developed economy, these rates are referred to as **risk-free rates** because it can be assumed that the government will make the promised payments on these securities, which can therefore be viewed as being free of **credit risk**.

A 3-month US Treasury bill (T-bill) is an example of such a security. T-bills are priced at a discount to their face value and pay their face value at maturity. The following example shows how we can derive a T-bill's rate of return from its price.

EXAMPLE: Rate of return for a 3-month US T-bill

A 3-month US T-bill with a principal value of \$1,000 will mature in 90 days. The T-bill's price is \$991.55. Calculate the annualized risk-free rate implied by this price, using a 365-day year.

Answer:

The total return of the T-bill over 90 days is calculated as:

$$r = \frac{P_1 - P_0 + \text{income}}{P_0} = \frac{1,000 - 991.55 + 0}{991.55} = 0.008522, \text{ or } 0.8522\%$$

The annualized return, r_{annual} , is calculated as follows:

$$r_{\text{annual}} = (1.008522)^{\frac{365}{90}} - 1 = 0.0350, \text{ or } 3.50\%.$$

If market interest rates increase, the value of fixed-income securities decreases, leading to negative price return.

EXAMPLE: Impact of increasing rates on price of a 3-month US T-bill

Calculate the change in price of the 90-day US T-bill from the previous example if the annualized 3-month risk-free rate (based on a 365-day year) increases to 4.0%.

Answer:

The new 90-day interest rate is calculated as:

$$r_{\text{annual}} = (1.04)^{\frac{90}{365}} - 1 = 0.009718, \text{ or } 0.9718\%$$

The new price of the T-bill is:

$$\text{price} = \frac{\text{principal}}{1 + r_{90\text{-day}}} = \frac{1,000}{1.009718} = 990.38$$

If the annualized 90-day risk-free rate increases from 3.5% to 4.0%, the price of a 90-day T-bill decreases by $\$991.55 - \$990.38 = \$1.17$.

As we will see in the Fixed Income topic area, price sensitivity to changes in market interest rates is more pronounced for longer-dated bonds, which have more fixed cash flows over a longer time frame.

Changes in the perceived creditworthiness of the issuer also affect the value of fixed-income securities. If the issuer's default risk increases, the value of the bond decreases. Debt issued by governments is usually considered to have lower default risk than corporate debt.

Foreign exchange rates represent the value of one country's currency expressed in the value of a different currency. For example, the amount of US dollars (USD) per British pound (GBP) could be quoted as $1 \text{ GBP} = 1.35 \text{ USD}$. Changes in foreign exchange rates affect returns for international investors holding foreign assets. A weakening foreign currency decreases the returns in domestic currency terms of investments that are denominated in the weakening currency; a strengthening foreign currency increases returns for an investor who holds assets denominated in that currency.



PROFESSOR'S NOTE

Domestic currency return refers to returns in the investor's home currency and includes the impact of changes in exchange rates. The return of a foreign asset in foreign currency terms (i.e., ignoring the impact of foreign exchange rates) is called the *local currency return*. We will discuss foreign exchange rates in more detail, along with quotation conventions used on the Level I exam, in the Economics topic area. For now, simply pay attention to how changes in foreign exchange rates can affect returns.

EXAMPLE: Impact of foreign exchange rates on returns

A US investor invests in UK company shares at a price of GBP 4.00 per share, when the exchange rate is 1.400 USD per GBP. The investor holds the shares for a year, at the end of which the company pays a dividend of GBP 0.08 per share, the share price is GBP 4.40, and the exchange rate is 1.3393 USD per GBP. Calculate the return to the investor in USD.

Answer:

Original cost of the shares in USD = GBP 4.00 $\times$ 1.4000 = USD 5.60

Final value of the shares plus the dividend income in USD =
(GBP 4.40 + GBP 0.08) $\times$ 1.3393 = USD 6.00

Domestic return to the US investor is calculated as:

$$r_{\text{USD}} = \frac{\text{ending USD value} - \text{starting USD value}}{\text{starting USD value}} \\ = \frac{\text{USD } 6.00 - \text{USD } 5.60}{\text{USD } 5.60} = 0.0714, \text{ or } 7.14\%$$

Another way to reach the same result is to combine the local return of the foreign asset, r_{GBP} , with the return of foreign exchange rate, r_{FX} :

$$\text{Local currency return of the foreign asset} = r_{\text{GBP}} = \frac{P_1 - P_0 + \text{income}}{P_0} = \\ \frac{\text{GBP } 4.40 - \text{GBP } 4.00 + \text{GBP } 0.08}{\text{GBP } 4.00} = 0.12, \text{ or } 12\%$$

$$\text{Return of the foreign exchange rate} = r_{\text{FX}} = \frac{1.3393 - 1.4000}{1.4000} = -0.04336, \\ \text{or } -4.336\%$$

Then, the domestic return, r_{USD} , is calculated by compounding these two sources of return:

$$r_{\text{USD}} = (1 + 0.12)(1 - 0.04336) - 1 \\ = (1.12)(0.9566) - 1 = 0.0714, \text{ or } 7.14\%$$

The domestic return to the US investor (7.14%) is lower than the local return in the foreign market (12%) due to a weakening of the foreign currency (-4.336%).