Portfolio Management

Study Sessions 17 & 18

Weight on Exam	5% to 8%
SchweserNotes™ Reference	Book 5, Pages 1–135

STUDY SESSION 17: PORTFOLIO MANAGEMENT (1)

PORTFOLIO MANAGEMENT: AN OVERVIEW

Cross-Reference to CFA Institute Assigned Reading #48

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 48.1 provides a summary of the risk tolerance, investment horizon, liquidity needs, and income objectives for these different types of investors.

Figure 48.1: 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

Cross-Reference to CFA Institute Assigned Reading #49

Risk and Return of Major Asset Classes

Based on U.S. data over the period 1926–2017, Figure 49.1 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 49.1: 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.

$$\text{variance} = \sigma^2 = \sum_{i=1}^{n}\left\{[R_i - E(R)]^2 \times P_i\right\}$$
$$\text{standard deviation} = \sigma = \sqrt{\sigma^2}$$

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.

$$\text{cov}_{1,2} = \frac{\sum_{t=1}^{n}\left\{[R_{t,1} - \overline{R}_1]\,[R_{t,2} - \overline{R}_2]\right\}}{n-1}$$

1 2018 Ibbotson SBBI Yearbook

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:

$$\sigma_p = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2\rho_{12}}$$

which is equivalent to:

$$\sigma_p = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\text{Cov}_{12}}$$

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:

$$\sigma_{portfolio} = \sqrt{Var_{portfolio}} = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2(1)}$$
$$= w_1\sigma_1 + w_2\sigma_2$$

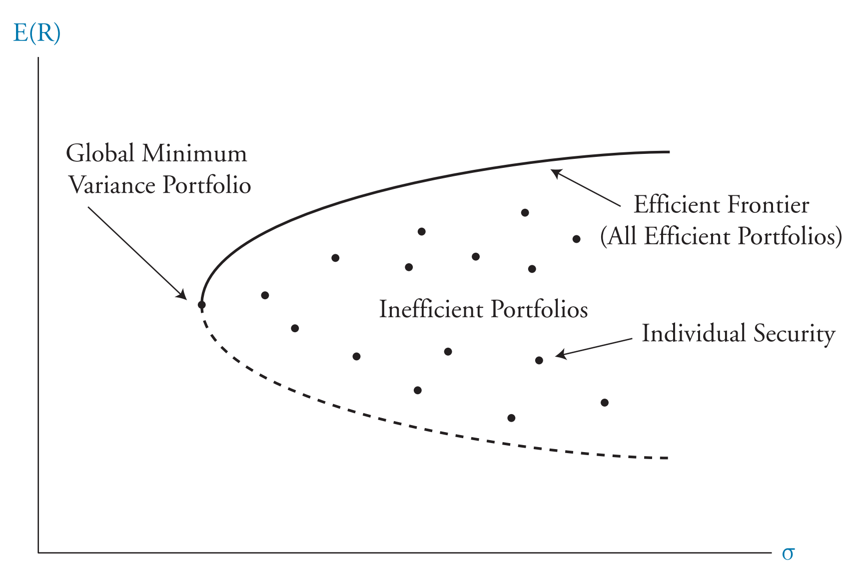
In this unique case, with $\rho_{12} = +1$, the portfolio standard deviation is simply the weighted average of the standard deviations of the individual asset returns.

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 49.2: 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:

$$E(R_{portfolio}) = W_A E(R_A) + W_B E(R_B)$$

$$\sigma_{portfolio} = \sqrt{W_A^2 \sigma_A^2 + W_B^2 \sigma_B^2 + 2 W_A W_B \rho_{AB} \sigma_A \sigma_B}$$

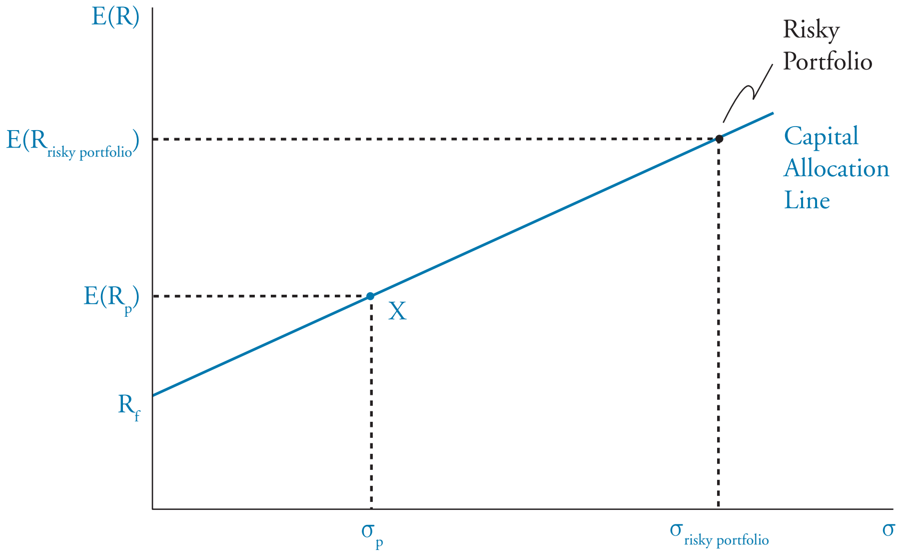
allow Asset B to be the risk-free asset and Asset A to be a risky portfolio of assets.

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 49.3.

Figure 49.3: Capital Allocation Line and Risky Asset Weights

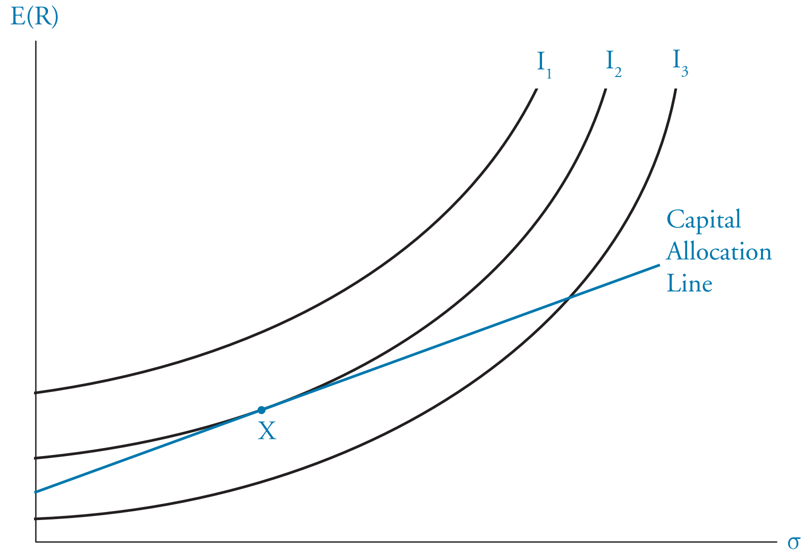


Combining a risky portfolio with a risk-free asset is the process that supports the **two-fund separation theorem**, which states that all investors' optimum portfolios will be made up of some combination of an optimal portfolio of risky assets and the risk-free asset. The line representing these possible 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 49.3 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 $0.40[E(R_{\text{risky asset portfolio}})] + 0.60(R_f)$ and its standard deviation will be $0.40(\sigma_{\text{risky asset portfolio}})$.

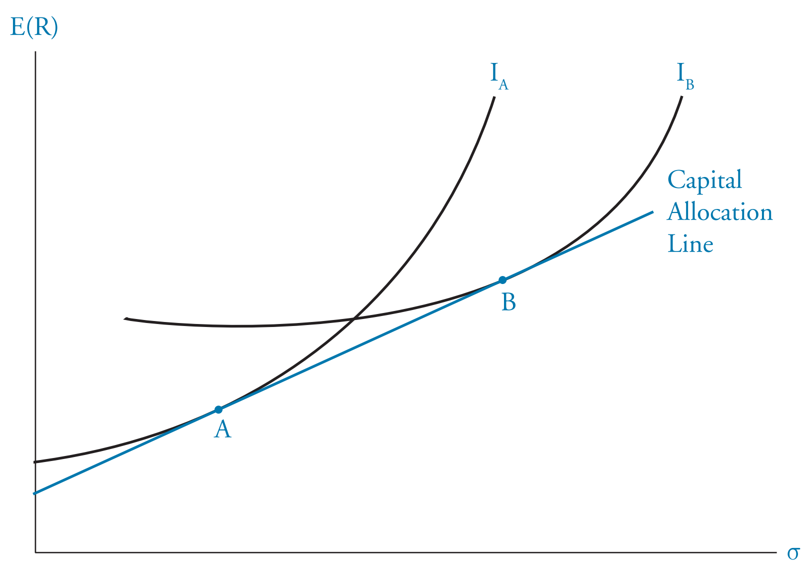
We can combine the capital allocation line with indifference curves to illustrate the logic of selecting an optimal portfolio (i.e., one that maximizes the investor's expected utility). In Figure 49.4, we can see that an investor with preferences represented by indifference curves I_1, I_2, and I_3 can 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 49.4: 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 49.5, 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 49.5: Portfolio Choices Based on Investor's Indifference Curves

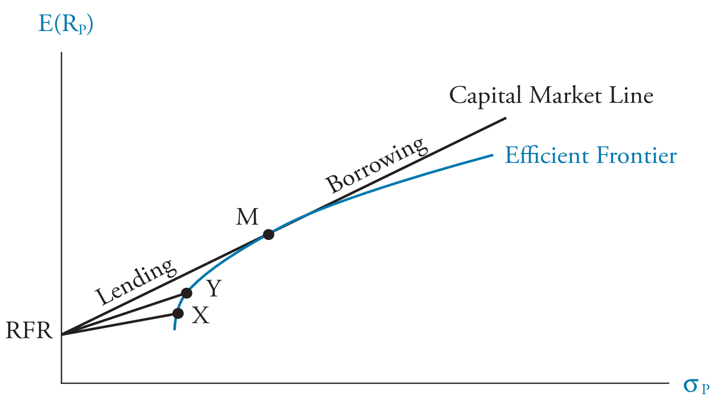


PORTFOLIO RISK AND RETURN: PART II

Cross-Reference to CFA Institute Assigned Reading #50

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 50.1: 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.

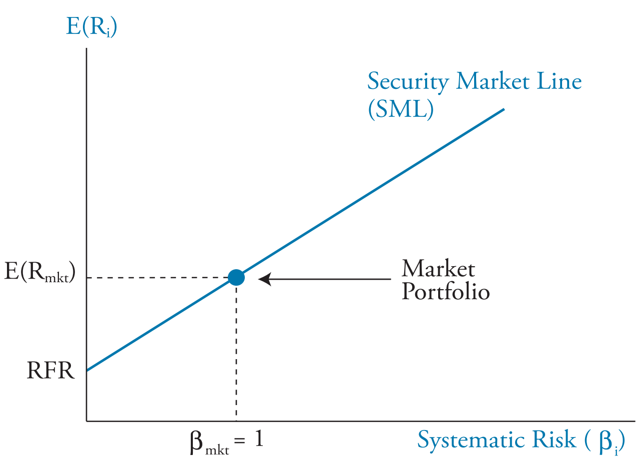
In short, adding a risk-free asset to the set of risky assets considered in the Markowitz portfolio theory results in a new efficient frontier that is now a straight line, the capital market line (CML).

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 50.2.

Figure 50.2: 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.

> total risk = systematic risk + 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.

> CAPM: $E(R_i) = RFR + [E(R_{MKT}) - RFR] \times beta_i$

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 βs) 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:

$$\rho_{im} = \frac{Cov_{im}}{\sigma_i \sigma_m}$$

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:

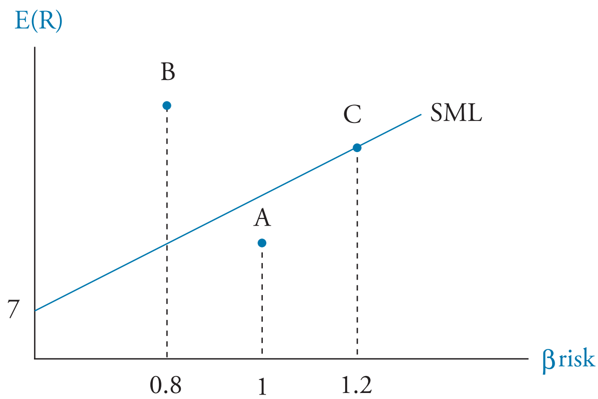
$$\beta_i = \frac{\rho_{im} \sigma_i \sigma_m}{\sigma_m^2} = \rho_{im} \frac{\sigma_i}{\sigma_m}$$

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 50.3 based on their forecast returns.

Figure 50.3: 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.

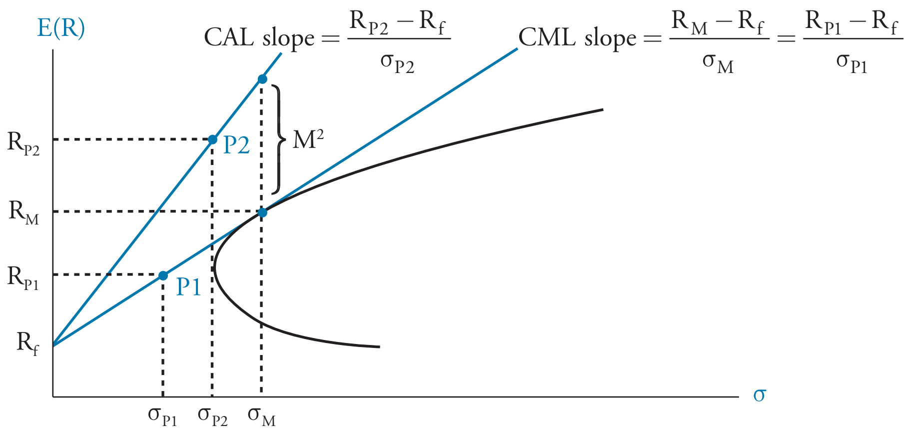
A portfolio with greater risk than the benchmark portfolio (especially beta risk) is expected to produce higher returns over time than the benchmark portfolio. When evaluating the performance of a portfolio with risk that differs from that of a benchmark portfolio, we need to adjust active portfolio 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.

$$\text{Sharpe ratio} = \frac{E\left[R_{\text{portfolio}}\right] - R_f}{\sigma_{\text{portfolio}}}$$

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 50.4, 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 50.4: 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 50.4). It is calculated for Portfolio 2 as:

$$(R_{P2} - R_f)\frac{\sigma_M}{\sigma_{P2}} - (R_M - R_f)$$

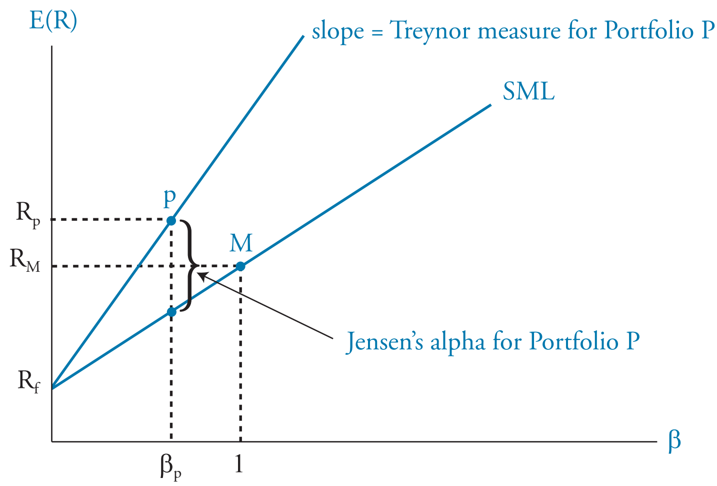
The difference between the Sharpe ratio and M^2 measure is that Sharpe is a slope measure and M^2 is measured in percentage terms. M^2 is also considered a measure of **risk-adjusted performance** (RAP).

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 50.5.

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 50.5.

Figure 50.5: Treynor Measure and Jensen's Alpha



STUDY SESSION 18: PORTFOLIO MANAGEMENT (2)

BASICS OF PORTFOLIO PLANNING AND CONSTRUCTION

Cross-Reference to CFA Institute Assigned Reading #51

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 12-month euro LIBOR 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

Cross-Reference to CFA Institute Assigned Reading #52

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

Cross-Reference to CFA Institute Assigned Reading #53

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.

Non-financial 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

Cross-Reference to CFA Institute Assigned Reading #54

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

Cross-Reference to CFA Institute Assigned Reading #55

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).