Portfolio Management

Study Session 12

Weight on Exam	7%
SchweserNotes™ Reference	Book 4, Pages 112–195

Portfolio Management: An Overview

Cross-Reference to CFA Institute Assigned Reading #40

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.

- 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.

Investment Management Clients

Individual investors save and invest for a variety of reasons, including purchasing a house or educating their children. In many countries, special accounts allow citizens to invest for retirement and to defer any taxes on investment income and gains until the funds are withdrawn. Defined contribution pension plans are popular vehicles for these investments.

Many types of **institutions** have large investment portfolios. **Defined benefit pension plans** are funded by company contributions and have an obligation to provide specific benefits to retirees, such as a lifetime income based on employee earnings.

An **endowment** is a fund that is dedicated to providing financial support on an ongoing basis for a specific purpose. A **foundation** is a fund established for charitable purposes to support specific types of activities or to fund research related to a particular disease.

The investment objective of a **bank** is to earn more on the bank's loans and investments than the bank pays for deposits of various types. Banks seek to keep risk low and need adequate liquidity to meet investor withdrawals as they occur.

Insurance companies invest customer premiums with the objective of funding customer claims as they occur.

Investment companies manage the pooled funds of many investors. **Mutual funds** manage these pooled funds in particular styles (e.g., index investing, growth investing, bond investing) and restrict their investments to particular subcategories of investments (e.g., large-firm stocks, energy stocks, speculative bonds) or particular regions (emerging market stocks, international bonds, Asian-firm stocks).

Sovereign wealth funds refer to pools of assets owned by a government.

Figure 1 provides a summary of the risk tolerance, investment horizon, liquidity needs, and income objectives for these different types of investors.

Figure 1: Characteristics of Different Types of Investors

Investor	*Risk Tolerance*	*Investment Horizon*	*Liquidity Needs*	*Income Needs*
Individuals	Depends on individual	Depends on individual	Depends on individual	Depends on individual
DB pensions	High	Long	Low	Depends on age
Banks	Low	Short	High	Pay interest
Endowments	High	Long	Low	Spending level
Insurance	Low	Long—life Short—P&C	High	Low
Mutual funds	Depends on fund	Depends on fund	High	Depends on fund

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.

Risk Management: An Introduction

Cross-Reference to CFA Institute Assigned Reading #41

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 or faulty organizational processes 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.

Portfolio Risk and Return: Part I

Cross-Reference to CFA Institute Assigned Reading #42

Risk and Return of Major Asset Classes

Based on U.S. data over the period 1926–2008, Figure 2 indicates that small capitalization stocks have had the greatest average returns and greatest risk over the period. T-bills had the lowest average returns and the lowest standard deviation of returns.

Figure 2: Risk and Return of Major Asset Classes in the United States (1926–2008)[1]

Assets Class	*Average Annual Return (Geometric Mean)*	*Standard Deviation (Annualized Monthly)*
Small-cap stocks	11.7%	33.0%
Large-cap stocks	9.6%	20.9%
Long-term corporate bonds	5.9%	8.4%
Long-term Treasury bonds	5.7%	9.4%
Treasury bills	3.7%	3.1%
Inflation	3.0%	4.2%

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.

1. 2009 Ibbotson SBBI Classic Yearbook

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

Covariance can be standardized by dividing by the product of the standard deviations of the two securities. This standardized measure of co-movement is called their *correlation coefficient* or *correlation* and is computed as:

$$\text{correlation of assets 1 and 2} = \rho_{1,2} = \frac{\text{cov}_{1,2}}{\sigma_1\sigma_2} \text{ so that, } \text{cov}_{1,2} = \rho_{1,2}\sigma_1\sigma_2$$

Risk Aversion

A **risk-averse** investor is simply one that dislikes risk (i.e., prefers less risk to more risk). Given two investments that have equal expected returns, a risk-averse investor will choose the one with less risk (standard deviation, σ).

A **risk-seeking** (risk-loving) investor actually prefers more risk to less and, given equal expected returns, will choose the more risky investment. A **risk-neutral** investor has no preference regarding risk and would be indifferent between two such investments.

A risk-averse investor may select a very risky portfolio despite being risk averse; a risk-averse investor may hold very risky assets if he feels that the extra return he expects to earn is adequate compensation for the additional risk.

Risk and Return for a Portfolio of Risky Assets

When risky assets are combined into a portfolio, the expected portfolio return is a weighted average of the assets' expected returns, where the weights are the percentages of the total portfolio value invested in each asset.

The standard deviation of returns for a portfolio of risky assets depends on the standard deviations of each asset's return (σ), the proportion of the portfolio in each asset (w), and, crucially, on the covariance (or correlation) of returns between each asset pair in the portfolio.

Portfolio standard deviation for a two-asset portfolio:

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

which is equivalent to:

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

If two risky asset returns are perfectly positively correlated, $\rho_{12} = +1$, then the square root of portfolio variance (the portfolio standard deviation of returns) is equal to:

$$\sigma_{\text{portfolio}} = \sqrt{\mathrm{Var}_{\text{portfolio}}} = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2(1)} = w_1\sigma_1 + w_2\sigma_2$$

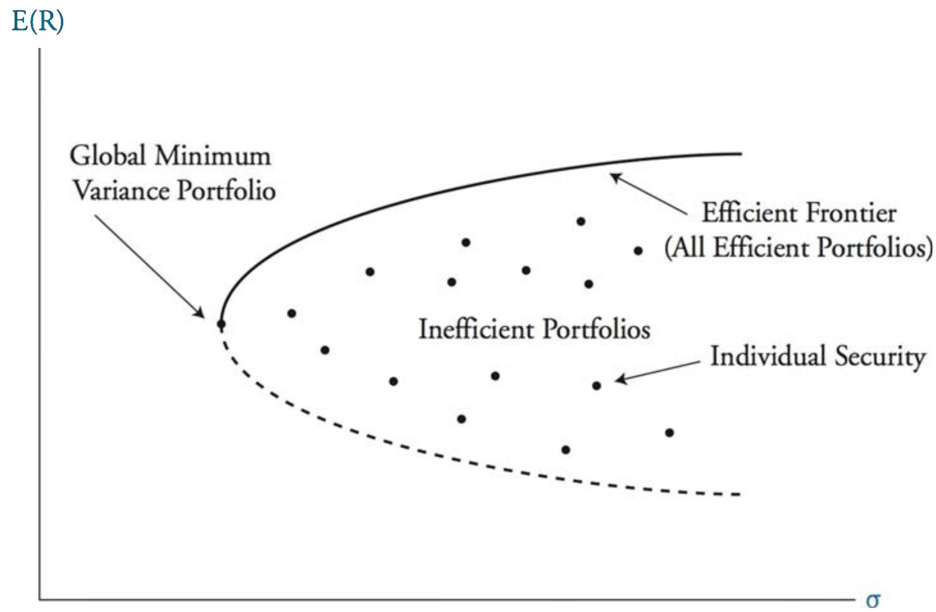
In this unique case, with $\rho_{12} = +1$, the portfolio standard deviation is simply the weighted average of the standard deviations of the individual asset returns.

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 3: Minimum Variance and Efficient Frontiers



An Investor's Optimal Portfolio

An investor's **expected utility function** depends on his degree of risk aversion. An **indifference curve** plots combinations of risk (standard deviation) and expected return among which an investor is indifferent, as they all have equal expected utility.

Indifference curves slope upward for risk-averse investors because they will only take on more risk if they are compensated with greater expected return. An investor who is relatively more risk averse requires a relatively greater increase in expected return to compensate for taking on greater risk. In other words, a more risk-averse investor will have steeper indifference curves.

In our previous illustration of efficient portfolios available in the market, we included only risky assets. When we add a risk-free asset to the universe of available assets, the efficient frontier is a straight line. Using the formulas:

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

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

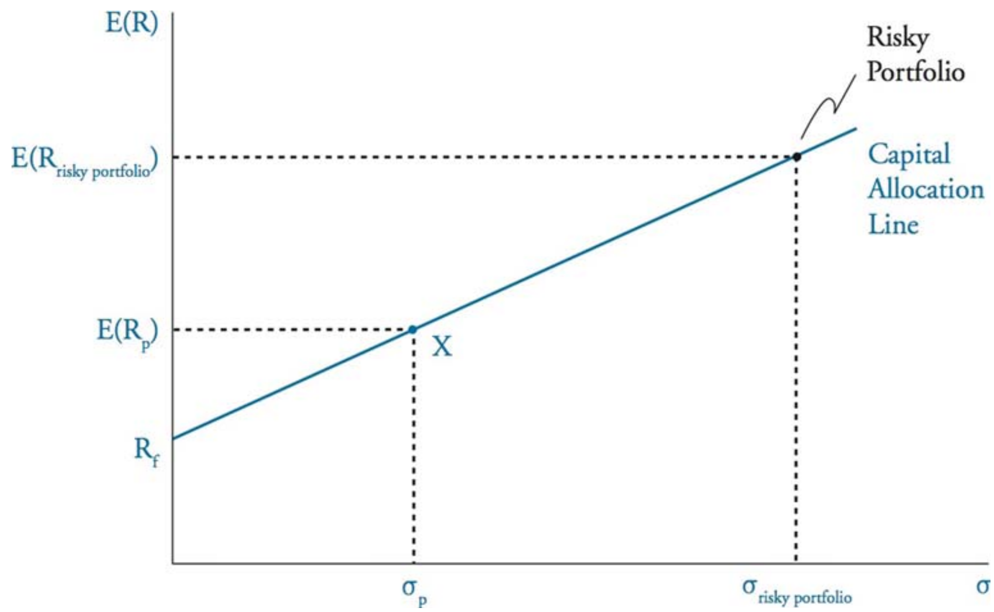
allow Asset B to be the risk-free asset and Asset A to be a risky portfolio of assets.

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:

$$\sigma_{\text{portfolio}} = \sqrt{W_A^2 \sigma_A^2} = W_A \sigma_A$$

If we put X% of our portfolio into the risky asset portfolio, the resulting portfolio will have standard deviation of returns equal to X% of the standard deviation of the risky asset portfolio. The relationship between portfolio risk and return for various portfolio allocations is linear, as illustrated in Figure 4.

Figure 4: Capital Allocation Line and Risky Asset Weights

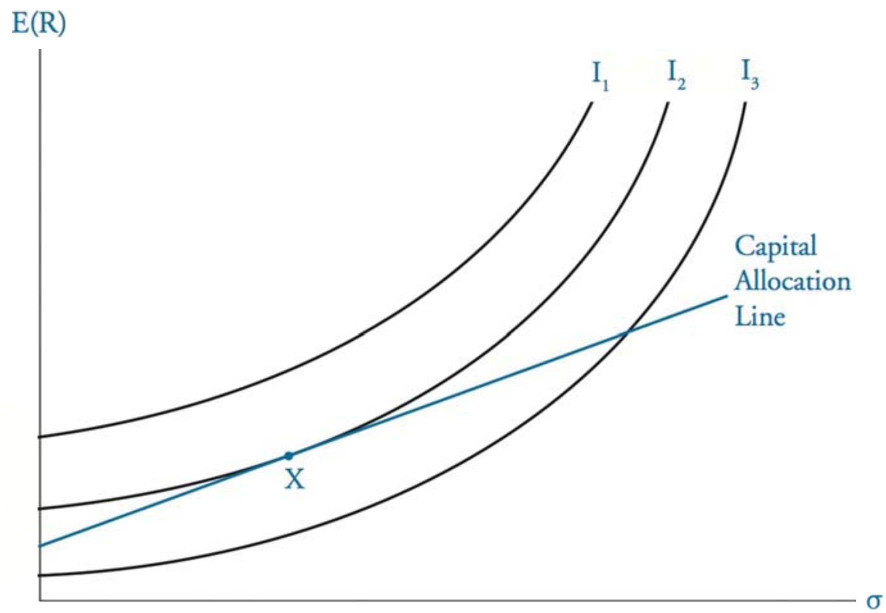


Combining a risky portfolio with a risk-free asset is the process that supports the **two-fund separation theorem**, which states that all investors' optimum portfolios will be made up of some combination of an optimal portfolio of risky assets and the risk-free asset. The line representing these possible combinations of risk-free assets and the optimal risky asset portfolio is referred to as the **capital allocation line**.

Point X on the capital allocation line in Figure 4 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 $0.40(\sigma_{\text{risky asset portfolio}})$.

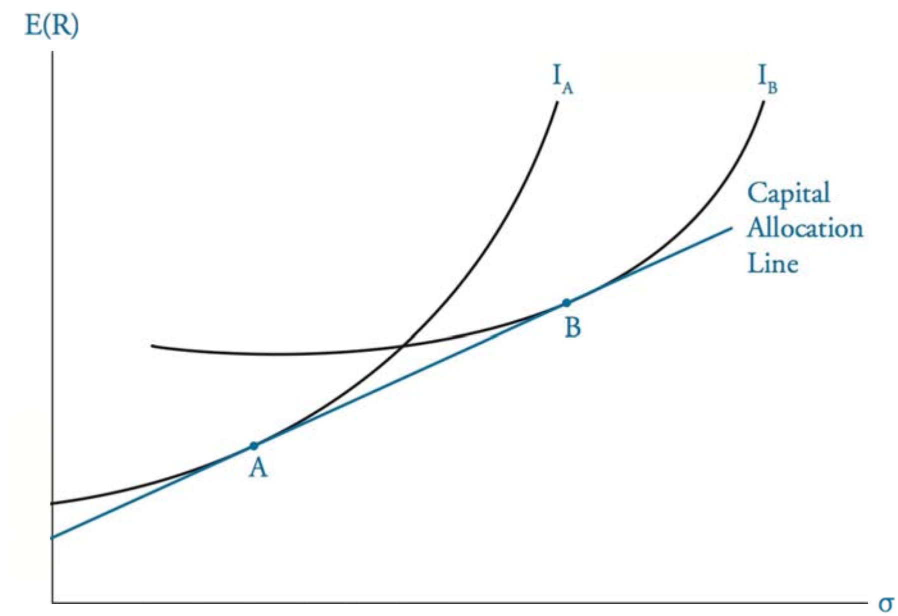
We can combine the capital allocation line with indifference curves to illustrate the logic of selecting an optimal portfolio (i.e., one that maximizes the investor's expected utility). In Figure 5, we can see that an investor with preferences represented by indifference curves I_1, I_2, and I_3 can reach the level of expected utility on I_2 by selecting portfolio X. This is the optimal portfolio for this investor, as any portfolio that lies on I_2 is preferred to all portfolios that lie on I_3 (and in fact to any portfolios that lie between I_2 and I_3). Portfolios on I_1 are preferred to those on I_2, but none of the portfolios that lie on I_1 are available in the market.

Figure 5: Risk-Averse Investor's Indifference Curves



The final result of our analysis here is not surprising; investors who are less risk averse will select portfolios with more risk. As illustrated in Figure 6, the flatter indifference curve for Investor B (I_B) results in an optimal (tangency) portfolio that lies to the right of the one that results from a steeper indifference curve, such as that for Investor A (I_A). An investor who is less risk averse should optimally choose a portfolio with more invested in the risky asset portfolio and less invested in the risk-free asset.

Figure 6: Portfolio Choices Based on Investor's Indifference Curves

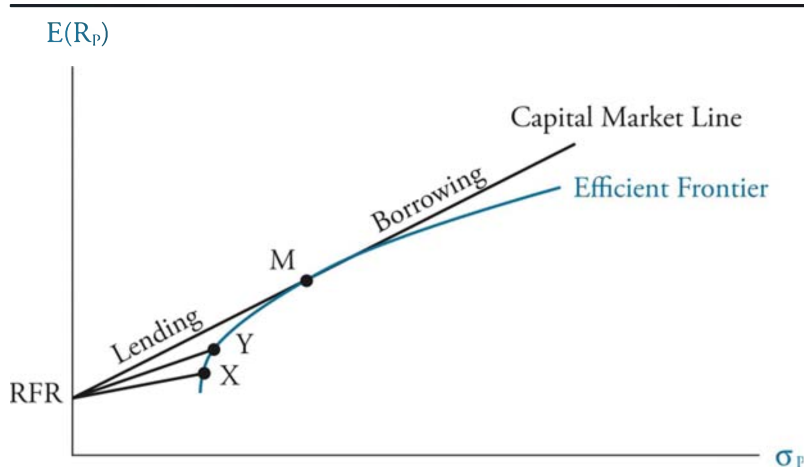


Portfolio Risk and Return: Part II

Cross-Reference to CFA Institute Assigned Reading #43

The following figure illustrates the possible risk-return combinations from combining a risk-free asset with three different (efficient) risky portfolios, X, Y, and M.

Figure 7: Combining a Risk-Free Asset With a Risky Portfolio



This figure also illustrates the point that combining a risk-free asset with risky Portfolio M (the *tangency* portfolio) results in the best available set of risk and return opportunities. Combining the risk-free asset with either Portfolio X or Portfolio Y results in a less preferred set of possible portfolios.

Since all investors who hold any risky assets will choose to hold Portfolio M, it must contain *all* available risky assets, and we can describe it as the "market portfolio."

Investors at Point M have 100% of their funds invested in Portfolio M. Between R_f and M, investors hold both the risk-free asset and Portfolio M. This means investors are *lending* some of their funds at the risk-free rate and investing the rest in the risky market Portfolio M. To the right of M, investors hold more than 100% of Portfolio M. This means they are *borrowing* funds to buy more of Portfolio M. The *levered positions* represent a 100% investment in Portfolio M and borrowing to invest even more in Portfolio M.

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

Security Market Line: Systematic and Unsystematic Risk

Under the assumptions of capital market theory, diversification is costless, and investors will only hold efficient portfolios. The risk that is eliminated by diversification is called *unsystematic risk* (also referred to as unique, diversifiable, or firm-specific risk). Since unsystematic risk is assumed to be eliminated at no cost, investors need not be compensated in equilibrium for bearing unsystematic risk.

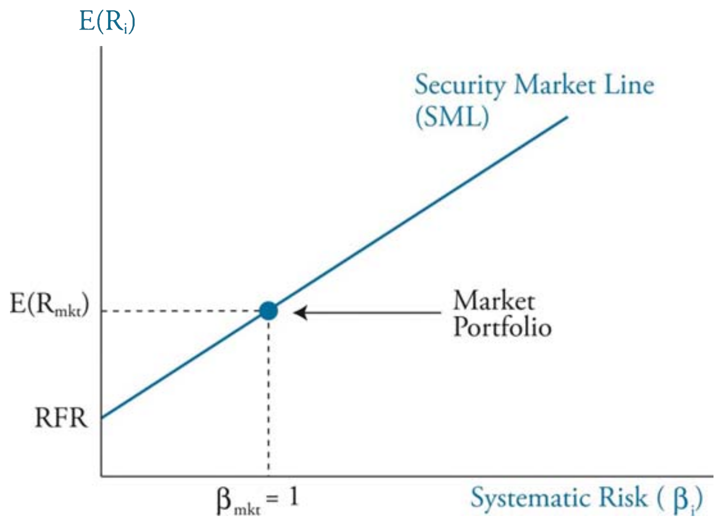
The risk that remains in efficient portfolios is termed *systematic risk* (also referred to as non-diversifiable or market risk), which is measured by an asset's or portfolio's beta. This crucial result is the basis for the capital asset pricing model (CAPM). The equilibrium relationship between systematic risk and expected return is illustrated by the security market line (SML) as shown in Figure 8.

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.

Figure 8: Security Market Line



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

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 *β*s) for Asset *i* multiplied by the expected value of that factor for the period. The first factor is often the expected excess return on the market, $E(R_m) - R_f$.

One multifactor model that is often used is that of Fama and French. They estimated the sensitivity of security returns to three factors: firm size, firm book value to market value ratio, and the return on the market portfolio minus the risk-free rate (excess return on the market portfolio). Carhart suggests a fourth factor that measures price momentum using prior period returns. Together, these four factors do a relatively good job of explaining returns differences for U.S. equity securities over the period for which the model has been estimated.

The **market model** is a single factor (sometimes termed single index) model. The only factor is the expected return on the market portfolio (market index).

The form of the market model is:

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

where:
R_i = Return on Asset i
R_m = Market return
β_i = Slope coefficient
α_i = Intercept
e_i = Abnormal return on Asset i

In the market model, the beta (factor sensitivity) of Asset *i* is a measure of the sensitivity of the return on Asset *i* to the return on the market portfolio.

Beta

The sensitivity of an asset's return to the return on the market index in the context of the market model is referred to as its **beta**. Beta is a standardized measure of the covariance of the asset's return with the market return. Beta can be calculated as follows:

$$\boxed{\beta_i = \frac{\text{covariance of Asset } i\text{'s return with the market return}}{\text{variance of the market return}} = \frac{Cov_{im}}{\sigma_m^2}}$$

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:

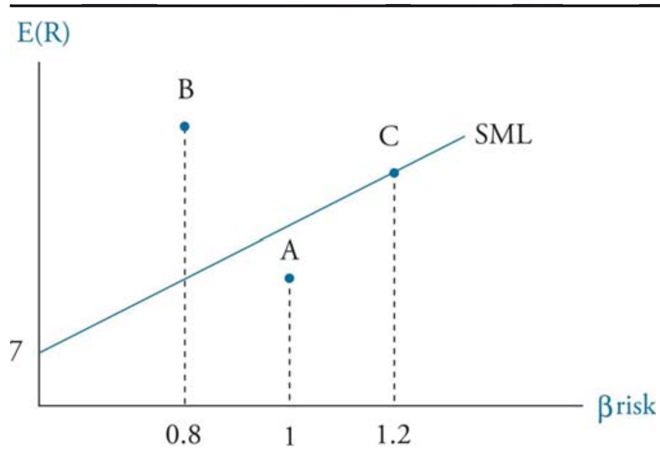
$$\beta_i = \frac{\rho_{im}\sigma_i\sigma_m}{\sigma_m^2} = \rho_{im}\frac{\sigma_i}{\sigma_m}$$

SML and Equilibrium

You should be able to compute an asset's expected return using the SML and determine whether the aseet is underpriced or overpriced relative to its equilibrium value. In solving problems, be careful to note whether you are given the expected return on the market, $E(R_M)$, or the market risk premium, $E(R_M) - R_f$.

An analyst may identify assets for which his forecasted returns differ from the expected return based on the asset's beta. Assets for which the forecasted return differs from its equilibrium expected returns will plot either above or below the SML. Consider three stocks, A, B, and C, that are plotted on the SML diagram in Figure 9 based on their forecasted returns.

Figure 9: Identifying Mispriced Securities



According to the forecasts, Asset B is underpriced, Asset A is overpriced, and Asset C is priced at its equilibrium value.

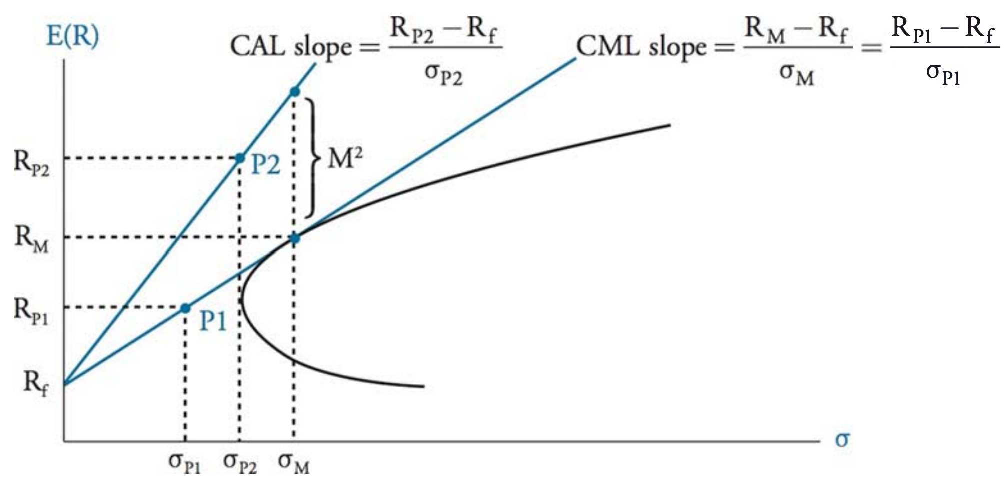
There are several measures of risk-adjusted returns that are used to evaluate relative portfolio performance.

One such measure is the **Sharpe ratio** $\left(\frac{R_P - R_f}{\sigma_P}\right)$.

The Sharpe ratio of a portfolio is its *excess returns per unit of total portfolio risk*, and higher Sharpe ratios indicate better risk-adjusted portfolio performance. Note that this is a slope measure and, as illustrated in Figure 10, the Sharpe ratios of all portfolios along the CML are equal. Because the Sharpe ratio uses total risk, rather than systematic risk, it accounts for any unsystematic risk that the portfolio manager has taken.

In Figure 10, we illustrate that the Sharpe ratio is the slope of the CAL for a portfolio and can be compared to the slope of the CML to evaluate risk-adjusted performance.

Figure 10: Sharpe Ratios as Slopes



The **M-squared** (M^2) measure produces the same portfolio rankings as the Sharpe ratio but is stated in percentage terms (as illustrated in Figure 10). It is calculated for Portfolio 2 as:

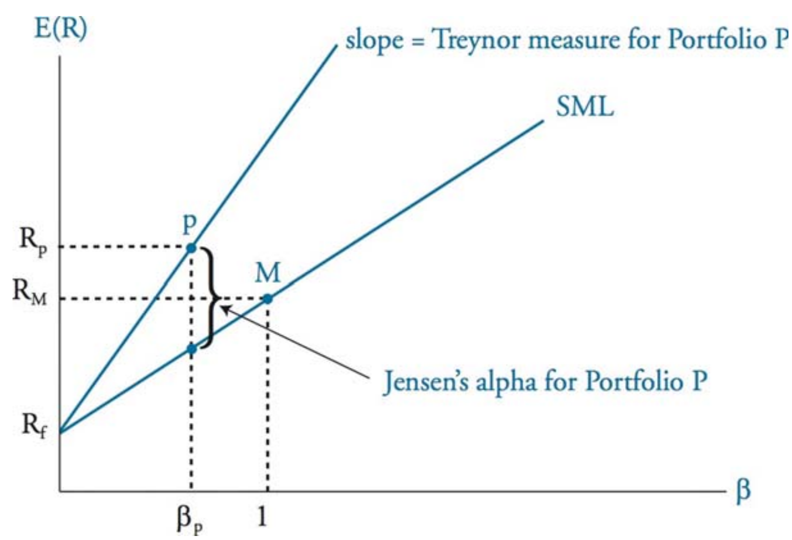
$$(R_{P2} - R_f)\frac{\sigma_M}{\sigma_{P2}} - (R_M - R_f)$$

Two measures of risk-adjusted returns based on systematic risk (beta) rather than total risk are the **Treynor measure** and **Jensen's alpha**. They are similar to the Sharpe ratio and M^2 measures in that the Treynor measure is a slope and Jensen's alpha is in percentage returns.

The Treynor measure is calculated as $\frac{R_P - R_f}{\beta_P}$, interpreted as excess returns per unit of systematic risk, and represented by the slope of a line as illustrated in Figure 11.

Jensen's alpha for Portfolio P is calculated as $\alpha_P = (R_P - R_f) - \beta_P(R_M - R_f)$ and is the percentage portfolio return above that of a portfolio (or security) with the same beta as the portfolio that lies on the SML, as illustrated in Figure 11.

Figure 11: Treynor Measure and Jensen's Alpha



Basics of Portfolio Planning and Construction

Cross-Reference to CFA Institute Assigned Reading #44

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.