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Capital Market Expectations and
Asset Allocation

LEVEL III BOOK 1

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Book 1: Capital Market Expectations and Asset Allocation

SchweserNotes™ 2024

LEVEL III CFA®



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Learning Outcome Statements (LOS)

1. Capital Market Expectations, Part 1: Framework and Macro Considerations

The candidate should be able to:

- a. discuss the role of, and a framework for, capital market expectations in the portfolio management process.
- b. discuss challenges in developing capital market forecasts.
- c. explain how exogenous shocks may affect economic growth trends.
- d. discuss the application of economic growth trend analysis to the formulation of capital market expectations.
- e. compare major approaches to economic forecasting.
- f. discuss how business cycles affect short- and long-term expectations.
- g. explain the relationship of inflation to the business cycle and the implications of inflation for cash, bonds, equity, and real estate returns.
- h. discuss the effects of monetary and fiscal policy on business cycles.
- i. interpret the shape of the yield curve as an economic predictor and discuss the relationship between the yield curve and fiscal and monetary policy.
- j. identify and interpret macroeconomic, interest rate, and exchange rate linkages between economies.

2. Capital Market Expectations, Part 2: Forecasting Asset Class Returns

The candidate should be able to:

- a. discuss approaches to setting expectations for fixed-income returns.
- b. discuss risks faced by investors in emerging market fixed-income securities and the country risk analysis techniques used to evaluate emerging market economies.
- c. discuss approaches to setting expectations for equity investment market returns.
- d. discuss risks faced by investors in emerging market equity securities.
- e. explain how economic and competitive factors can affect expectations for real estate investment markets and sector returns.
- f. discuss major approaches to forecasting exchange rates.
- g. discuss methods of forecasting volatility.
- h. recommend and justify changes in the component weights of a global investment portfolio based on trends and expected changes in macroeconomic factors.

3. Overview of Asset Allocation

The candidate should be able to:

- a. describe elements of effective investment governance and investment governance considerations in asset allocation.
- b. formulate an economic balance sheet for a client and interpret its implications for asset allocation.
- c. compare the investment objectives of asset-only, liability-relative, and goals-based asset allocation approaches.
- d. contrast concepts of risk relevant to asset-only, liability-relative, and goals-based asset allocation approaches.
- e. explain how asset classes are used to represent exposures to systematic risk and discuss criteria for asset class specification.
- f. explain the use of risk factors in asset allocation and their relation to traditional asset class-based approaches.
- g. recommend and justify an asset allocation based on an investor's objectives and constraints.
- h. describe the use of the global market portfolio as a baseline portfolio in asset allocation.
- i. discuss strategic implementation choices in asset allocation, including passive/active choices and vehicles for implementing passive and active mandates.
- j. discuss strategic considerations in rebalancing asset allocations.

4. Principles of Asset Allocation

The candidate should be able to:

- a. describe and evaluate the use of mean-variance optimization in asset allocation.
- b. recommend and justify an asset allocation using mean-variance optimization.

- c. interpret and evaluate an asset allocation in relation to an investor's economic balance sheet.
- d. recommend and justify an asset allocation based on the global market portfolio.
- e. discuss the use of Monte Carlo simulation and scenario analysis to evaluate the robustness of an asset allocation.
- f. discuss asset class liquidity considerations in asset allocation.
- g. explain absolute and relative risk budgets and their use in determining and implementing an asset allocation.
- h. describe how client needs and preferences regarding investment risks can be incorporated into asset allocation.
- i. describe the use of investment factors in constructing and analyzing an asset allocation.
- j. describe and evaluate characteristics of liabilities that are relevant to asset allocation.
- k. discuss approaches to liability-relative asset allocation.
- l. recommend and justify a liability-relative asset allocation.
- m. recommend and justify an asset allocation using a goals-based approach.
- n. describe and evaluate heuristic and other approaches to asset allocation.
- o. discuss factors affecting rebalancing policy.

5. Asset Allocation with Real-World Constraints

The candidate should be able to:

- a. discuss asset size, liquidity needs, time horizon, and regulatory or other considerations as constraints on asset allocation.
- b. discuss tax considerations in asset allocation and rebalancing.
- c. recommend and justify revisions to an asset allocation given change(s) in investment objectives and/or constraints.
- d. discuss the use of short-term shifts in asset allocation.
- e. identify behavioral biases that arise in asset allocation and recommend methods to overcome them.

READING 1

CAPITAL MARKET EXPECTATIONS, PART 1: FRAMEWORK AND MACRO CONSIDERATIONS

EXAM FOCUS

Combining capital market expectations with the investor's objectives and constraints leads to the portfolio's strategic asset allocation. A variety of economic tools and techniques are useful in forming capital market expectations for return, risk, and correlation by asset class. Unfortunately, no one technique works consistently, so be prepared for any technique and its issues as covered here.

MODULE 1.1: FORMULATING CAPITAL MARKET EXPECTATIONS



Video covering
this content is
available online.

LOS 1.a: Discuss the role of, and a framework for, capital market expectations in the portfolio management process.

Capital market expectations are risk and return expectations regarding classes of assets. Investors should establish long-term expectations for each allowable asset class specified in the investment policy statement. They can also create short-term expectations for making active investment decisions. Using a disciplined approach to set short- and long-term expectations leads to more effective security selection, asset allocation, and risk management.

Achieving long-term investment objectives is largely dependent on constructing proper asset allocations. Although projecting asset class returns may be subject to forecasting errors, investors should ensure that portfolios are internally consistent.

Cross-sectional consistency refers to consistency across asset classes regarding portfolio risk and return characteristics. **Intertemporal consistency** refers to consistency over various investment horizons regarding portfolio decisions over time.

To formulate capital market expectations, an analyst should use the following seven-step process:

- Step 1:* Determine the specific capital market expectations needed according to the investor's allowable asset classes and investment horizon(s). Time horizon is particularly important in determining the set of capital market expectations that are needed.
- Step 2:* Investigate assets' historical performance to determine the drivers that have affected past performance and to establish some range for plausible future performance. With the drivers of past performance established, the analyst can use these to forecast expected future performance as well as

compare the forecast to past results to see if the forecast appears reasonable.

Step 3: Identify the valuation model to be used and its requirements. For example, a comparables-based, relative value approach used in the United States may be difficult to apply in an emerging market analysis.

Step 4: Collect the best data possible. The use of faulty data will lead to faulty conclusions. Financial publications and commercial databases are likely the best sources for reliable information on asset classes.

Step 5: Use experience and judgment to interpret current investment conditions and decide what values to assign to the required inputs. Verify that the inputs used for the various asset classes are consistent across classes.

Step 6: Formulate capital market expectations. Any assumptions and rationales used in the analysis should be recorded.

Step 7: Monitor performance and use it to refine the process for setting expectations. If actual performance varies significantly from forecasts, the process and model should be refined.

Information needed to support the investment process includes:

- Geography—individual countries, economic blocks (e.g., EU), non-domestic vs. domestic, regional, and global.
- Major asset classes such as fixed income, equity, and real assets.
- Sub-asset classes:
 - Equity—industries, sectors, size, style
 - Fixed income—nominal vs. TIPS, floating vs. fixed, credit quality, maturities
 - Real assets—commodities, real estate, timber

Good forecasts are unbiased, objective, well researched, efficient (small forecasting error), and internally consistent. A general guideline is that at least 30 observations are needed to test a hypothesis.

Problems in Forecasting

LOS 1.b: Discuss challenges in developing capital market forecasts.

Poor forecasts can result in inappropriate asset allocations. Analysts should be aware of potential problems in data, models, and the resulting capital market expectations. Nine problems encountered in producing forecasts are (1) limitations to using economic data, (2) data measurement error and bias, (3) limitations of historical estimates, (4) the use of ex-post risk and return measures, (5) non-repeating data patterns, (6) failing to account for conditioning information, (7) misinterpreting of correlations, (8) psychological bias, and (9) model uncertainty.

1. There are several **limitations to using economic data**:

- The time lag between collection and distribution is often quite long. The International Monetary Fund, for example, reports data with a lag of as much as two years.

- Data are often revised and the revisions are not made at the same time as the publication. Additionally, data definitions and methodology change over time. For example, the basket of goods in the Consumer Price Index (CPI) is updated every few years.
- Data indexes are often rebased over time (i.e., the base upon which they are calculated is changed). Although a rebasing is not a substantial change in the data itself, the unaware analyst could calculate changes in the value of the indexes incorrectly if she does not make an appropriate adjustment.

2. There are numerous possible **data measurement errors and biases**.

Transcription errors are the misreporting or incorrect recording of information and are most serious if they are biased in one direction. *Survivorship bias* commonly occurs if a manager or a security return series is deleted from the historical performance record of managers or firms. Deletions are often tied to poor performance and bias the historical return upward. *Appraisal data* for illiquid and infrequently priced assets makes the path of returns appear smoother than it actually is. This biases downward the calculated standard deviation and makes the returns seem less correlated (closer to 0) with more liquid priced assets. This is a particular problem for some types of alternative assets such as real estate.

3. The **limitations of historical estimates** can also hamper the formation of capital market expectations. Values from historical data must often be adjusted going forward as economic, political, regulatory, and technological environments change. This is particularly true for volatile assets such as equity. These changes are known as *regime changes* and result in *nonstationary* data. For example, the global financial crisis in 2007–2009 resulted in returns data that were markedly different than those from the previous five years. Nonstationarity would mean different periods in the time series have different statistical properties and create problems with standard statistical testing methods.

Two questions can be used to help resolve the issue of which time period to select:

- a. Is there a reason to believe the entire (longer) time period is not appropriate?
- b. If the answer to the first question is yes, does a statistical test confirm there is a regime change and the point in the time series where it occurs?

If both answers are yes, the analyst must use judgment to select the relevant subperiod.

Historical data are a starting point for estimating expected returns, standard deviations, and correlations. A long time period is preferable for several reasons:

- It may be statistically required: To calculate historical covariance (and correlation), the number of data points must exceed the number of covariances to be calculated.
- A larger data set (time period) provides more precise statistical estimates with smaller variance to the estimates.
- Using a short time period creates a temptation to use more frequent data, such as weekly data, rather than monthly data points in order to have a larger sample size. Unfortunately, more frequent data points are often more likely to have missing or outdated values (this is called *asynchronous* data) and can result in

distorted correlation calculations. Also, it has been found that more frequent data will not improve the precision of expected returns.

However, long time periods also create the potential problem of including regime changes, which are shifts in underlying fundamentals. Each regime change creates a subperiod with distinctly different characteristics.

In addition to selecting time periods, caution should be exercised when data are assumed to be normally distributed. Asset returns have historically exhibited “fat tails” and skewness, which adds complexity to statistical tests. In some cases, the benefits of accounting for non-normality might not outweigh the costs of introducing complexity to a model.

4. Using **ex post data** (after the fact) to determine **ex ante** (before the fact) risk and return can be problematic. For example, suppose that several years ago investors were fearful that the Federal Reserve was going to have to raise interest rates to combat inflation. This situation would cause depressed stock prices. If inflation abated without the Fed’s intervention, then stock returns would increase once the inflation scenario passed. Looking back on this situation, the researcher would conclude that stock returns were high while being blind to the prior risk that investors had faced. The analyst would then conclude that future (ex ante) returns for stocks will be high. In sum, the analyst would underestimate the risks that equity investors face and overestimate their potential returns.

This issue could also lead to an overestimation of risk when sample data include rare negative events. Using a data subset that includes outliers will likely distort the estimation of value at risk (VaR). This would suggest that rare negative events are expected with more frequency than would be observed in practice.

5. Using historical data, analysts can also uncover patterns in security returns that are unlikely to occur in the future and can produce biases in the data. One such bias is *data mining*. Just by random chance, some variables will appear to have a relationship with security returns, when, in fact, these relationships are unlikely to persist. For example, if the analyst uses a 5% significance level and examines the relationship between stock returns and 40 randomly selected variables, two (5%) of the variables are expected to show a statistically significant relationship with stock returns just by random chance. Another potential bias results from the time span of data chosen (*time period bias*). For example, small-cap U.S. stocks are widely thought to outperform large-cap stocks, but their advantage disappears when data from 2000 to 2010 are excluded.

To avoid these biases, an analyst should first ask if there is any economic basis for the variables found to be related to stock returns. Second, he should scrutinize the modeling process for susceptibility to bias. Third, the analyst should test the discovered relationship with out-of-sample data to determine if the relationship is persistent. This would be done by estimating the relationship with one portion of the historical data and then reexamining it with another portion.

6. Analysts’ forecasts may also fail to account for **conditioning information**. The relationship between security returns and economic variables is not constant over time. Historical data reflect performance over many different business cycles and economic conditions. Thus, analysts should account for current conditions in their forecasts. As an example, suppose a firm’s beta is estimated at 1.2 using historical data. If, however, the original data are separated into two ranges by economic

expansion or recession, the beta might be 1.0 in expansions and 1.4 in recessions. Going forward, the analyst's estimate of the firm's beta should reflect whether an expansion is expected (i.e., the expected beta is 1.0) or a recession is expected (i.e., the expected beta is 1.4).

7. Another problem in forming capital market expectations is the **misinterpretation of correlations** (i.e., causality). Suppose the analyst finds that corn prices were correlated with rainfall in the midwestern United States during the previous quarter. It would be reasonable to conclude that rainfall influences corn prices. It would not be reasonable to conclude that corn prices influence rainfall. Rainfall is an exogenous variable (i.e., it arises outside the model), whereas the price of corn is an endogenous variable (i.e., it arises within the model).

It is also possible that the correlation between two variables is spurious or that a third variable influences both variables. In addition, two variables may have a nonlinear relationship that is missed by the correlation statistic, which measures linear relationships.

8. Analysts are susceptible to **psychological biases**:

- In the **anchoring bias** (cognitive), the first information received is overweighted. If, during a debate on the future of the economy, the first speaker forecasts a recession, that forecast is given greater credence.
- In the **status quo bias** (emotional), predictions are highly influenced by the recent past. If inflation is currently 4%, that becomes the forecast, rather than choosing to be different and potentially making an active error of commission.
- In the **confirmation bias** (cognitive), only information supporting the existing belief is considered, and such evidence may be actively sought while other evidence is ignored. To counter these tendencies, analysts should give all evidence equal scrutiny and seek out contrary opinions.
- In the **overconfidence bias** (emotional), past mistakes are ignored, the lack of comments from others is taken as agreement, and the accuracy of forecasts is overestimated. To counter this bias, consider a range of potential outcomes.
- In the **prudence bias** (cognitive), forecasts are overly conservative to avoid the regret from making extreme forecasts that could end up being incorrect. This bias can also be mitigated by considering a range of potential outcomes.
- In the **availability bias** (cognitive), what is easiest to remember (often an extreme event) is overweighted. Many believe that the U.S. stock market crash of 1929 may have depressed equity values in the subsequent 30 years. To counter this bias, base predictions on objective data rather than emotions or recollections of the past.



PROFESSOR'S NOTE

Five of these six biases are the same as in the behavioral readings; the prudence bias is the same as the conservatism bias in the behavioral readings.

9. **Model uncertainty** refers to selecting the correct model. An analyst may be unsure whether to use a discounted cash flow (DCF) model or a relative value model to evaluate an expected stock return. *Parameter uncertainty* refers to estimation errors in model parameters. *Input uncertainty* refers to knowing the

correct input values for the model. For example, even if the analyst knew that the DCF model was appropriate, the correct growth and discount rates are still needed. Among the three types of uncertainty, model uncertainty is the most serious given that an incorrect model will likely lead to invalid conclusions.



MODULE QUIZ 1.1

1. An analyst uses a variety of valuation approaches for different asset classes and collects the necessary data from multiple sources. The analyst does not make any effort to systematically compare the data used. As a result, the analyst uses relatively low discount rates for equity analysis (overestimating theoretical value) and high discount rates for fixed income (underestimating theoretical value). **Discuss** the likely effect on the analyst's asset allocation recommendations.
2. An analyst would like to forecast U.S. equity returns. He is considering using either the last 3 years of historical annual returns or the last 50 years of historical annual returns. **Provide** an argument for and against each selection of data length.
3. **Explain** why smoothed data may be present for some types of alternative investments and the consequences for their risk and correlation with other assets from using such data.

MODULE 1.2: THE TREND RATE OF GROWTH



Video covering this content is available online.

LOS 1.c: Explain how exogenous shocks may affect economic growth trends.

Identifying problems in developing forecasts is important when setting capital market expectations. However, a far greater concern is the connection between investment outcomes and economic output. In general, economic growth can be partitioned into cyclical variations and growth trends. The former is more short-term focused whereas the latter is more relevant for determining long-term return expectations. Later in this topic review, we will discuss how the business cycle influences short- and long-term expectations. In this section, we will discuss the application of growth trends when formulating expectations.

Economic growth trends are subject to unexpected surprises or shocks that are exogenous to the economy. Many shocks and their impact on capital markets cannot be predicted. For example, turmoil in the Middle East may change the long-term trend for oil prices, inflation, and economic growth in the developed world. Shocks may also arise through the banking system. An extreme example is the U.S. banking crisis of the 1930s, when a severe slowdown in bank lending paralyzed the economy.

Exogenous shocks are unanticipated events that occur outside the normal course of an economy. Because the events are unanticipated, they are not already built into current market prices, whereas normal trends in an economy, which would be considered endogenous, are built into market prices. Note that the impact of these events will likely produce statistical regime changes. Exogenous shocks can be caused by several factors:

- **Changes in government policies.** Government policies that can encourage long-term growth include sound fiscal policy, minimal government interference with free markets, facilitating competition in the private sector, development of infrastructure and human capital, and sound tax policies.
- **Political events.** Geopolitical tensions that divert resources to less productive uses may lead to decreases in growth. Conversely, cuts in defense spending due to higher levels of world peace may lead to increases in growth.
- **Technological progress.** The creation of new and innovative markets, products, and technologies has the potential to improve growth.
- **Natural disasters.** Natural disasters likely reduce short-term growth, but may (arguably) encourage long-term growth if more efficient capacity replaces previous capacity.



PROFESSOR'S NOTE

The counterargument here is that the owners of capital already replace old facilities with newer and more efficient ones when the time is right.

- **Discovery of natural resources.** Production of new natural resources or the introduction of new ways to recover existing resources can enhance growth. In addition, decreases in resource production costs will improve growth while decreases in resource supply will restrict growth.
- **Financial crises.** Shocks to the financial system will lead to a crisis of confidence among market participants. Financial crises may reduce the level of economic output in the short term and may also decrease the trend rate of growth.

LOS 1.d: Discuss the application of economic growth trend analysis to the formulation of capital market expectations.

The trend rate of growth is an important input when setting capital market expectations. Some of the key considerations of economic growth trend analysis are as follows:

- Forecasting returns with DCF models incorporate the trend rate of growth. The need to keep these forecasts consistent with long-term economic growth imposes discipline on the models. The trend rate of growth acts as an anchor for long-term bond and equity returns.
- Higher trend growth rates may lead to higher stock returns assuming the growth is not already reflected in stock prices.
- When we speak of higher trend growth rates, we mean the economy can grow at a faster pace before inflation becomes a major concern. This consideration influences monetary policy and the level of bond yields.
- Higher trend growth rates tend to generate higher government bond yields.

Overall, the trend rate of growth is relatively stable in developed economies. In emerging economies, that growth rate can be less predictable and include longer periods of rapid growth as those economies catch up with developed economies.

A basic model for forecasting the economic growth rate focuses on the following:

- *Labor input*, based on growth in the labor force and labor participation. Growth in the labor force depends on population growth and demographics. Labor participation refers to the percentage of the population working and is affected by real wages, work/leisure decisions, and social factors.
- *Capital per worker*, which increases labor productivity.
- *Total factor productivity*, which is reflected in technological progress and changes in government policies.

EXAMPLE: Forecasting the long-term economic growth rate

Assume that the population is expected to grow by 2% and that labor force participation is expected to grow by 0.25%. If spending on new capital inputs is projected to grow at 2.5% and total factor productivity will grow by 0.5%, what is the long-term projected growth rate?

Answer:

The sum of the components equals $2\% + 0.25\% + 2.5\% + 0.5\% = 5.25\%$, so the economy is projected to grow by this amount.

Asset Returns and the Trend Rate of Growth

The trend rate of growth can also provide an estimate for long-term equity returns. The market value of equity can be expressed as the product of three terms: nominal GDP, earnings/GDP (which is the share of profits in the economy), and the P/E ratio.

Over long periods, the share of profits in the economy (earnings/GDP) and the P/E ratio cannot continually increase or decrease thus, in the long-term, the growth rate of the total value of equity in an economy is linked to the growth rate of GDP.

This applies to the capital appreciation component of equity returns but not the dividend yield. The dividend yield (annual dividends/market value) can be derived from the dividend payout ratio (dividends/profit) divided by the profit multiple (market value/profit).

EXAMPLE: Forecasting long-run equity return

Cindy Navaro is an equity analyst for Evergreen Asset Management. She has been asked to produce capital market expectations for asset classes in several different markets relevant to the company's Renewable Green Energies fund. Navaro is aware that long-term GDP trend forecasting is considered the starting point to form capital market expectations. In order to make a forecast of trend GDP growth in the domestic economy, Navaro collects the following data displayed in Exhibit 1.

Exhibit 1: Domestic Economy Information

Annual labor input growth	0.4%
Annual labor productivity growth	1.4%
Annual inflation	3.8%
Dividend yield	2.6%
Long-term change in profits as a share of GDP	0%
Long-term change in PE multiples	0%

Based on the data in Exhibit 1, the projected long-term domestic market equity return is *closest* to:

- 4.4%.
- 5.6%.
- 8.2%.

Explanation:

The correct answer is 8.2%.

Real GDP growth = labor input growth + labor productivity growth = 0.4% + 1.4% = 1.8%

Nominal GDP growth = real GDP growth + inflation = 1.8% + 3.8% = 5.6%

Long-term capital gains in equity markets = %Δ nominal GDP + %Δ profits/GDP + %Δ PE = 5.6% + 0% + 0% = 5.6%

Long-term total domestic market equity return = capital gains + dividend yield = 5.6% + 2.6% = 8.2%

High rates of growth in capital investment are associated with high rates of growth in the economy. However, these high growth rates are not necessarily linked to favorable equity returns. This may be the case because growth rates are already factored into equity prices. An additional explanation is that the source of equity returns is related to the rate of return on capital. If the rate of growth of capital is faster than the rate of economic growth, return on capital may decrease and equity returns may become less attractive.

Market Forecasting

LOS 1.e: Compare major approaches to economic forecasting.

Three approaches to economic forecasting are econometric modeling, use of economic indicators, and a checklist approach.

Econometric analysis uses statistical methods to explain economic relationships and formulate forecasting models. *Structural models* are based on economic theory while *reduced-form models* are compact versions of structural approaches. These types of models range from being quite simple to very complex, involving several or hundreds of relationships. For example, an analyst may want to forecast GDP using current and lagged consumption and investment values. Ordinary least squares regression is most often used, but other statistical methods are also used to develop these models.

Advantages:

- Modeling can incorporate many variables.
- Once the model is specified, it can be reused.
- Output is quantified and based on a consistent set of relationships.

Disadvantages:

- Models are complex and time-consuming to construct.
- The data may be difficult to forecast and the relationships can change.
- Output may require interpretation or be unrealistic.
- It does not work well to forecast turning points.

Economic indicators are available from governments, international organizations (e.g., the Organization of Economic Cooperation and Development), and private organizations (e.g., the Conference Board in the United States).

Many analysts use a combination of publicly available indicators and their own proprietary indicators. The most useful indicators are **leading indicators** that move ahead of the business cycle with a reasonable stable lead time. These can be used to predict what will happen next. The leading indicators can be used individually or as a **composite**. For example, the Conference Board provides 10 leading indicators for the United States, which they combine into an index. Traditionally, three consecutive months of increase (decrease) for the index are expected to signal the start of an economic expansion (contraction) within a few months. A composite can also be interpreted as a **diffusion index** by observing the number of indicators pointing toward expansion versus contraction in the economy.

There are also **coincident** and **lagging indicators** that move with and after changes in the business cycle. These can be used to confirm what is happening in the economy.

Advantages:

- Economic indicators are simple, intuitive, and easy to interpret.
- Data are often readily available from third parties.
- Indicator lists can be tailored to meet specific forecasting needs.

Disadvantages:

- Forecasting results have been inconsistent.
- Economic indicators have given false signals.
- Indicators are revised frequently, which can make them appear to fit past business cycles better than they did when the data were first released.

A **checklist approach** is more subjective. In this approach, an analyst considers a series of questions. For example, to forecast GDP, the analyst may consider, "What was the latest employment report? What is the central bank's next move, given the latest information released? What is the latest report on business investment?" Then the analyst uses judgment and perhaps some statistical modeling to interpret the answers and formulate a forecast. Judgment is required both in determining which factors to consider and how to interpret them.

Advantages:

- Less complex than econometrics.
- Flexible in mixing objective statistical analysis with judgment to incorporate changing relationships.

Disadvantages:

- Subjective.
- Time-consuming.
- Complexity must be limited due to manual process.

MODULE 1.3: THE BUSINESS CYCLE



Video covering
this content is
available online.

LOS 1.f: Discuss how business cycles affect short- and long-term expectations.

As mentioned, the trend rate of growth provides guidance on setting long-term expectations. Any deviations from this trend tend to cancel out over the long run; however, identifying these deviations can be very useful when making shorter-term projections. Fluctuations in economic growth over short to intermediate time horizons are often associated with the business cycle.

A fundamental reason why economic activity is cyclical is the nature of business decisions. Decision makers allocate resources to what they believe are their highest valued uses, but can only do so with imperfect information. Adjustments to unexpected events take time to implement and reversing incorrect decisions can be costly.

Understanding business cycle phases is important for forming capital market expectations, but their relationship is not straightforward for the following reasons:

1. Business cycles vary in duration and intensity, and their turning points are difficult to predict. Their variations may be thought of as resulting from the interactions of many subcycles with a wide range of frequencies.
2. Although we typically think of and model economic activity in terms of cycles fluctuating around a long-term trend, it can be difficult to distinguish which effects result from shorter-term factors that arise from the business cycle and which are related to longer-term factors that affect the trend rate of economic growth.
3. Returns in the capital market are strongly related to activity in the real economy, but they also depend on factors such as investors' expectations and risk tolerances.

Business cycle analysis is most useful for identifying opportunities within the time horizon of a typical business cycle. For longer investment horizons that are likely to include one or more full business cycles, information about the current state of the economy is less valuable.

Business Cycle Phases

For the Exam: Have a working knowledge of, and be able to explain, the general relationships between interest rates, inflation, stock and bond prices, et cetera, as you progress over the business cycle. For example, as the peak of the cycle approaches, everything is humming along. Confidence and employment are high, but inflation is starting to have an impact on markets. As inflation increases, bond yields increase and both bond and stock prices start to fall.

The business cycle can be subdivided into five phases: (1) initial recovery, (2) early expansion, (3) late expansion, (4) slowdown, and (5) contraction. The phases have the following characteristics:

Initial Recovery

- Duration of a few months.
- Business confidence rising.
- Government stimulus provided by low interest rates and/or budget deficits.
- Decelerating inflation.
- Large output gap.
- Low or falling short-term interest rates.
- Bond yields bottoming out.
- Rising stock prices.
- Cyclical, riskier assets such as small-cap stocks and high yield bonds doing well.

Early Expansion

- Duration of a year to several years.
- Increasing growth with low inflation.
- Increasing confidence.
- Rising short-term interest rates.
- Output gap is narrowing.
- Stable or rising bond yields.
- Rising stock prices.

Late Expansion

- High confidence and employment.
- Output gap eliminated and economy at risk of overheating.
- Increasing inflation.
- Central bank limits the growth of the money supply.
- Rising short-term interest rates.
- Rising bond yields.
- Rising/peaking stock prices with increased risk and volatility.

Slowdown

- Duration of a few months to a year or longer.
- Declining confidence.

- Inflation still rising.
- Short-term interest rates at a peak.
- Bond yields peaking and possibly falling, resulting in rising bond prices.
- Possible inverting yield curve.
- Falling stock prices.

Contraction

- Duration of 12 to 18 months.
- Declining confidence and profits.
- Increase in unemployment and bankruptcies.
- Inflation topping out.
- Falling short-term interest rates.
- Falling bond yields, rising prices.
- Stock prices increasing during the latter stages, anticipating the end of the recession.

Inflation Implications

LOS 1.g: Explain the relationship of inflation to the business cycle and the implications of inflation for cash, bonds, equity, and real estate returns.

Inflation means generally rising prices. For example, if the CPI increases from 100 to 105, inflation is 5%. Inflation typically accelerates late in the business cycle (near the peak).

Disinflation means a deceleration in the rate of inflation. For example, if the CPI then increases from 105 to 108, the rate of inflation decreases to approximately 3%. Inflation typically decelerates as the economy approaches and enters recession.

Deflation means generally falling prices. For example, if the CPI declines from 108 to 106, the rate of inflation is approximately -2%. Deflation is a severe threat to economic activity for the following reasons:

- It encourages default on debt obligations. Consider a homeowner who has a home worth \$100,000 and a mortgage of \$95,000; the homeowner's equity is only \$5,000. A decline of more than 5% in home prices leads to negative equity and can trigger panic sales (further depressing prices), defaulting on the loan, or both.
- With negative inflation, interest rates decline to near zero and this limits the ability of central banks to lower interest rates and stimulate the economy. Following the financial crisis of 2007–2009 and the resulting very low interest rates, several central banks tried a new monetary policy of **quantitative easing (QE)** to stimulate the economies of their countries. Traditionally, central banks have used open market operations to increase the money supply and decrease short-term interest rates on a temporary basis by buying high quality fixed-income instruments. QE was different in that it was larger in scale, the purchases

included other security types such as mortgage-backed securities and corporate bonds, and the intent was a long-term increase in bank reserves.

Monetary policy and inflation levels will vary over the business cycle. In general, moderate levels of inflation only create moderate costs for the economy. As a result, central banks tend to target a slightly positive inflation rate. Investors generally expect that equity and bond prices will reflect some level of positive inflation.

Figure 1.1 summarizes the relationship of inflation to the business cycle. Figure 1.2 describes the typical behavior of asset class returns in different inflation scenarios.

Figure 1.1: Inflation and the Business Cycle

The Business Cycle	Inflation	Economic Policy	Markets
Initial recovery	Initially declining inflation	Stimulative	Short-term rates low or declining Long-term rates bottoming and bond prices peaking Stock prices increasing
Early expansion	Low inflation and good economic growth	Becoming less stimulative	Short-term rates increasing Long-term rates bottoming or increasing with bond prices beginning to decline Stock prices increasing
Late expansion	Inflation rate increasing	Becoming restrictive	Short-term and long-term rates increasing with bond prices declining Stock prices peaking and volatile
Slowdown	Inflation continues to accelerate	Becoming less restrictive	Short-term and long-term rates peaking and then declining with bond prices starting to increase Stock prices declining
Contraction	Real economic activity declining and inflation peaking	Easing	Short-term and long-term rates declining with bond prices increasing Stock prices begin to increase later in the recession

Figure 1.2: Inflation Expectations and Asset Classes

Inflation within expectations	<p>Cash equivalents: Earn the real rate of interest</p> <p>Bonds: Shorter-term yields more volatile than longer-term yields</p> <p>Equity: No impact given predictable economic growth</p> <p>Real estate: Neutral impact with typical rates of return</p>
Inflation above or below expectations	<p>Cash equivalents: Positive (negative) impact with increasing (decreasing) yields</p> <p>Bonds: Longer-term yields more volatile than shorter-term yields</p> <p>Equity: Negative impact given the potential for central bank action or falling asset prices, though some companies may be able to pass rising costs on to customers</p> <p>Real estate: Positive impact as real asset values increase with inflation</p>
Deflation	<p>Cash equivalents: Positive impact if nominal interest rates are bound by 0%</p> <p>Bonds: Positive impact as fixed future cash flows have greater purchasing power (assuming no default on the bonds)</p> <p>Equity: Negative impact as economic activity and business declines</p> <p>Real estate: Negative impact as property values generally decline</p>



PROFESSOR'S NOTE

These generalizations will not hold in every case. They are a good starting point for a forecaster taking a macro approach. Even if the generalizations always held, it is not easy to determine when a business cycle phase starts, how long it will last, or when it ends.



MODULE QUIZ 1.2, 1.3

1. An analyst believes that GDP is best forecasted using a system of equations that can capture the fact that GDP is a function of many variables, both current and lagged values. Which economic forecasting method is she *most likely* to use?
2. The phase of the business cycle in which we *most likely* expect to observe rising short-term interest rates and stable bond yields is:
 - A. late expansion.
 - B. initial recovery.
 - C. early expansion.
3. **Describe** how bonds and equities typically perform during deflationary periods.

MODULE 1.4: MONETARY AND FISCAL POLICY



Video covering this content is available online.

LOS 1.h: Discuss the effects of monetary and fiscal policy on business cycles.

Monetary Policy

Central banks often use monetary policy as a countercyclical force, attempting to optimize the economy's performance. Most central banks strive to balance price stability against economic growth. The ultimate goal is to keep growth near its long-run sustainable rate, because growth faster than the long-run rate usually results in increased inflation. As discussed previously, the later stages of an economic expansion are often characterized by increased inflation. As a result, central banks usually resort to restrictive policies toward the end of an expansion. The risk at this stage is that they may overtighten and cause a recession.

To spur growth, a central bank can take actions to reduce short-term interest rates. This results in greater consumer spending, greater business spending, higher stock prices, and higher bond prices. Lower interest rates also usually result in a lower value of the domestic currency, which is thought to increase exports. In addition to the direction of change, the level of interest rates is important. If, for example, rates are increased to 4% to combat inflation, but this is still low compared to the average of 6% in a country, then this absolute rate may still be low enough to allow growth while the rise in rates may begin to dampen inflation. The equilibrium interest rate in a country (the rate at which a balance between growth and inflation is achieved) is referred to as the neutral rate. It is generally thought that the neutral rate is composed of an inflation component, a real growth component, and judgment from policy makers. If, for example, inflation is targeted at 3% and the economy is expected to grow by 2%, then the neutral rate would be 5%.

The neutral rate is the rate that most central banks strive to achieve as they attempt to balance the risks of inflation and recession. If inflation is too high, the central bank should increase short-term interest rates. If economic growth is too low, it should decrease interest rates. The **Taylor rule** embodies this concept. Thus, it is used as a prescriptive tool (i.e., it states what the central bank should do). It also is fairly accurate at predicting central bank action.

The Taylor rule determines the target interest rate using the neutral rate, expected GDP relative to its long-term trend, and expected inflation relative to its targeted amount. It can be formalized as follows:

$$n_{\text{target}} = r_{\text{neutral}} + i_{\text{expected}} + [0.5(\text{GDP}_{\text{expected}} - \text{GDP}_{\text{trend}}) + 0.5(i_{\text{expected}} - i_{\text{target}})]$$

where:

n_{target} = target nominal short-term interest rate

r_{neutral} = neutral real short-term interest rate

$\text{GDP}_{\text{expected}}$ = expected GDP growth rate

$\text{GDP}_{\text{trend}}$ = long-term trend in the GDP growth rate

i_{expected} = expected inflation rate

i_{target} = target inflation rate

EXAMPLE: Calculating the short-term interest rate target

Given the following information, **calculate** the nominal short-term interest rate target.

Neutral rate	3%
Inflation target	2%
Expected inflation	4%
GDP long-term trend	2%
Expected GDP growth	0%

Answer:

$$\begin{aligned} r_{\text{target}} &= 3\% + 4\% + [0.5(0\% - 2\%) + 0.5(4\% - 2\%)] \\ &= 7\% + (-1\% + 1\%) = 7\% \end{aligned}$$

In this example, weak projected economic growth would call for cutting interest rates if inflation were not a consideration. If the central bank was only concerned with growth, the target interest rate would be 1% lower than the neutral rate. However, the higher projected inflation overrides the growth concern because projected inflation is 2% greater than the target inflation rate. In net, the target rate is 7% because the concern over high inflation overrides the weak growth concern.



PROFESSOR'S NOTE

The Taylor rule can also be expressed in terms of the real inflation-adjusted target rate by moving expected inflation to the left-hand side of the equation.

$$r_{\text{target}} - i_{\text{expected}} = r_{\text{neutral}} + [0.5(\text{GDP}_{\text{expected}} - \text{GDP}_{\text{trend}}) + 0.5(i_{\text{expected}} - i_{\text{target}})]$$

Negative Interest Rates

Negative interest rates were generally considered a hypothetical curiosity before the 2007–2009 financial crisis. A *negative rate* is defined as a net payment made to keep money on deposit at a financial institution or payment of a net fee to invest in short-term instruments.

Zero was regarded as the sustainable lower rate of interest because investors could hold physical cash instead (earning no interest). As investors withdrew funds from banks to hold cash, bank balance sheets would shrink as they paid out funds and stopped making loans. Simple supply and demand analysis should dictate that with a smaller supply of funds available to lend, the price paid (interest rate) to borrow increases.

The flaw in this analysis was that negative interest rates did not cause the expected large move into physical cash. The daily exchange of funds in modern economies is too large. The implicit advantages of being able to quickly transfer large amounts of money held on deposit to settle transactions outweighed the explicit cost of holding those deposits at negative rates. Without the exit of funds from the banking system, it turned out that negative interest rates were sustainable for extended periods.

As mentioned earlier, the slowdown in economic activity during the crisis and already very low interest rates led some central banks to experiment with less-tested monetary policy—QE approach. QE led to larger injections of funds by central banks into the commercial banking system with the announced intent that

these injections were long term in nature. The hope was this would stimulate bank lending and increase economic activity.

Negative interest rates should, in theory, have similar effects. Holders of funds would find it more desirable to spend the money, stimulating economic activity; or, they would invest in longer-term stocks and bonds, driving up prices and creating a wealth effect. Or, negative rates would lead consumers and businesses to borrow at zero or negative rates to spend now.

How these new policies actually end up working remains to be seen. For the policies to work, consumers, investors, and businesses have to believe the risk of spending now is worth it. Purchases and investments made now provide positive economic benefit in the future. But negative interest rates also signal uncertainty as to what the future holds.

Negative interest rates complicate the process of forming capital market expectations:

- The risk-free rate is the starting point for buildup models used to estimate long-run returns for asset classes. When the risk-free rate is negative, a sustainable expected risk-free rate, such as the policy neutral rate in the Taylor rule, is more appropriate as that starting point. That rate is generally not regarded as fully risk free, so a modest default premium can be removed.
- Forming capital market expectation over shorter time horizons is further complicated by a need to forecast the time path over which negative rates will converge to a long-run sustainable risk-free rate. Multiple path projections should be considered to allow for uncertainty regarding how the convergence will occur.
- Another approach to shorter-term projections of asset class returns is to interpret negative risk-free rates as being consistent with contraction or early recovery stages of the business cycle.
- Using historical data as a starting point for forecasting is more problematic because few comparable periods exist, and the negative rates suggest significant structural economic changes are occurring. This kind of regime change makes statistics based on historical data less reliable, requiring more subjective assessments. Anticipating the effects of negative rates when combined with less-tested QE makes forecasting even more challenging.

Fiscal Policy

Another tool at the government's disposal for managing the economy is fiscal policy. If the government wants to stimulate the economy, it can implement loose fiscal policy by decreasing taxes or increasing spending, thereby increasing the budget deficit. If they want to rein in growth, the government does the opposite to implement fiscal tightening.

There are two important aspects to fiscal policy. First, it is not the level of the budget deficit that matters—it is the change in the deficit. For example, a deficit by itself does not stimulate the economy, but increases in the deficit are required to stimulate the economy. Second, changes in the deficit that occur naturally over the course of the business cycle are not stimulative or restrictive. In an expanding economy, deficits will decline because tax receipts increase and disbursements to

the unemployed decrease. The opposite occurs during a recession. Only changes in the deficit directed by government policy will influence growth.

The Yield Curve

LOS 1.i: Interpret the shape of the yield curve as an economic predictor and discuss the relationship between the yield curve and fiscal and monetary policy.

The yield curve demonstrates the relationship between interest rates and the maturity of debt securities. The curve is sensitive to government actions as well as current and expected economic conditions. When both fiscal and monetary policies are expansive, for example, the yield curve is sharply upward sloping (i.e., short-term rates are lower than long-term rates), and the economy is likely to expand in the future. When fiscal and monetary policies are restrictive, the yield curve is downward sloping (i.e., it is *inverted*, as short-term rates are higher than long-term rates), and the economy is likely to contract in the future.

Fiscal and monetary policies may reinforce or conflict with each other. If the policies reinforce each other, the implications for the economy are clear. In all cases, there are likely implications for the yield curve:

- If both policies are stimulative, the yield curve is steep and the economy is likely to grow.
- If both policies are restrictive, the yield curve is inverted and the economy is likely to contract.
- If monetary policy is restrictive and fiscal policy is stimulative, the yield curve is flat and the implications for the economy are less clear.
- If monetary policy is stimulative and fiscal policy is restrictive, the yield curve is moderately steep and the implications for the economy are less clear.

In terms of the business cycle, the yield curve is typically steep at the bottom of the cycle. As the cycle moves toward expansion, the curve tends to flatten. At the top of the cycle, the yield curve will likely be flat to inverted. During contraction, the curve will begin to re-steepen. Given these expectations, analysts can use the yield curve as a predictor of the state of the economy as well as the future path of interest rates. However, analysts should also exercise caution that these relationships may not always hold.

International Considerations

LOS 1.j: Identify and interpret macroeconomic, interest rate, and exchange rate linkages between economies.

Economic links between countries have become increasingly important with globalization, especially for small countries with undiversified economies. Larger

countries with diverse economies, such as the United States, are less affected but still influenced by globalization.

Macroeconomic links can produce convergence in business cycles among economies. International trade produces one such link, as a country's exports and economy are depressed by a slowdown in a trading partner's economy and level of imports. International capital flows produce another link if cross-border capital investing by a trading partner declines as its economy contracts.

A country's current account and capital account are measures of macroeconomic linkages. The current account largely consists of a country's net exports while the capital account reflects net investment flows. The two accounts are opposites of each other in that a surplus in one account will produce a deficit in the other.

A useful relationship for understanding how the current account influences economic activity is the following formula:

net exports = net private saving + government surplus

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

where:

X = exports

M = imports

S = private saving

I = investment spending

T = tax

G = government spending

Interest rates and currency exchange rates can also create linkages. A strong link is created when a smaller economy "pegs" its currency to that of a larger and more developed economy. The peg is a unilateral declaration by the pegging country to maintain the exchange rate. In general, the linkage between the business cycles of the two economies will increase, as the pegged currency country must follow the economic policies of the country to which it has pegged its currency. If not, investors will favor one currency over the other and the peg will fail.

Generally, the interest rates of the pegged currency will exceed the interest rates of the currency to which it is linked, and the interest rate differential will fluctuate with the market's confidence in the peg. If confidence is high, the rate differential can be small. If there is doubt the peg will be maintained, investors will require a larger interest rate differential as compensation for the risk of holding the pegged currency. A common problem arises if investors begin to lose confidence in the pegged currency and it begins to decline in value. The pegging country must then increase short-term interest rates to attract capital and maintain the value of the currency at the peg.

In the absence of pegging, the relationship of interest rate differentials and currency movement can reflect several factors:

- If a currency is substantially overvalued and expected to decline, bond interest rates are likely to be higher to compensate foreign investors for the expected decline in the currency value.
- Relative bond yields, both nominal and real, increase with strong economic activity and increasing demand for funds.
- Savings and investment decisions as well as capital productivity drive the level of real rates. Although real rates may differ across countries, there is a tendency for them to move up and down together given that global savings and investing are linked through the current account.



PROFESSOR'S NOTE

The relationship between currency values and interest rates is complicated. You may recall a theory from earlier levels that if real interest rates are equal and the movement of currency value consistently reflects the difference in inflation rates, then the forward exchange rate is a good predictor of what will happen in the currency market. The Level III material will not support those assumptions and does not support the use of the forward exchange rate as a predictor of what will happen. This is addressed in multiple readings.



MODULE QUIZ 1.4

1. During an economic expansion, an analyst notices that the budget deficit has been declining. She concludes that the government's fiscal policy has shifted to a more restrictive posture. **Comment** on her conclusion.
2. **Calculate** the nominal short-term interest rate target given the following information.

Neutral real rate	2%
Inflation target	3%
Expected inflation	5%
GDP long-term trend	3%
Expected GDP	4%

3. A forecaster notes that the yield curve is steeply upwardly sloping. **Comment** on the likely monetary and fiscal policies in effect and the future of the economy.
4. An analyst is evaluating two countries. Maldavia has a GDP of \$60 billion and an economy that is dominated by the mining industry. Ceania has a GDP of \$1.2 trillion and an economy that sells a variety of items. He is predicting a global economic slowdown. Which country is at greater risk?
5. At a conference, Larry Timmons states that a pegged exchange rate allows a less developed country to achieve greater currency and economic stability, as well as relatively lower and more stable interest rates, and to pursue the fiscal and economic policies to maximize the country's real economic growth. **Explain** what is correct and incorrect in Timmons's statement.

KEY CONCEPTS

LOS 1.a

Capital market expectations help in formulating the strategic asset allocation. They can also assist in detecting short-term asset mispricings exploitable through tactical

asset allocation. Asset allocations should display both cross-sectional and intertemporal consistency.

To formulate capital market expectations, use the following process:

- Determine the relevant capital market expectations given the investor's allowable asset classes and investment horizon(s).
- Investigate assets' historical performance as well as the determinants of their performance.
- Identify the valuation model used and its requirements.
- Collect the best data possible.
- Use experience and judgment to interpret current investment conditions.
- Formulate capital market expectations.
- Monitor performance and use it to refine the process.

LOS 1.b

Limitations in the use of economic data for forecasting include the following:

- Data are reported with a lag, subject to revision, and defined inconsistently in different countries.
- Data are subject to biases and errors such as transcription errors, survivorship bias, and smoothed (appraised) data estimates.
- Using historical data is less appropriate when economic conditions change (regime change and nonstationary issues).
- Ex-post risk generally understates ex-ante risk, as surviving the past does not guarantee the future cannot be worse.
- Data mining or selection of time periods may introduce biases.
- Models should be conditioned for the likely state of the economy.
- Correlation does not imply causation. Does A cause B, does B cause A, or are both associated with some other factor C?
- Psychological biases and cognitive errors may affect an analysis.
- Models, parameters, and inputs are subject to uncertainty.

LOS 1.c

Exogenous shocks are unanticipated events that occur outside the normal course of an economy and may have either a positive or negative impact on growth. They can be caused by different factors, such as changes in government policies, political events, technological progress, natural disasters, discovery of natural resources, and financial crises.

LOS 1.d

In forecasting a country's long-term economic growth trend, the trend growth rate can be decomposed into two main components and their respective subcomponents:

- Changes in employment levels, which are related to population growth and labor force participation.
- Changes in productivity, which are related to capital inputs and technological advancement.

LOS 1.e

Econometric analysis uses statistical methods to formulate forecasting models. These models range from being quite simple to very complex, involving several data items of various time period lags to predict the future.

Economic indicators attempt to characterize an economy's phase in the business cycle and are separated into lagging indicators, coincident indicators, and leading indicators. Analysts prefer leading indicators because they help predict the future path of the economy.

In a checklist approach, the analyst checks off a list of questions that should indicate the future growth of the economy. Given the answers to these questions, the analyst can then use her judgment to formulate a forecast or derive a more formal model using statistics.

LOS 1.f

Understanding business cycle phases is important for forming capital market expectations, but their relationship is not straightforward. Business cycles vary in duration and intensity, and their turning points are difficult to predict. It can be difficult to distinguish among factors that arise from the business cycle and factors that affect the trend rate of growth. Returns in the capital market are strongly related to activity in the real economy, but also depend on factors such as investors' expectations and risk tolerances.

The business cycle can be subdivided into five phases: (1) initial recovery, (2) early expansion, (3) late expansion, (4) slowdown, and (5) contraction.

LOS 1.g

Inflation varies over the business cycle, rising in the latter stages of an expansion and falling during a recession and the initial recovery. Deflation reduces the value of investments financed with debt (e.g., real estate) because leverage magnifies losses.

Bond prices will rise during a recession when inflation and interest rates are declining. In a strong expansion, bonds tend to decline in price as inflation expectations and interest rates rise.

Equities provide an inflation hedge when inflation is moderate. High inflation can be problematic because slow growth may result from central bank action to combat inflation. Deflation is harmful because it encourages defaults and limits the scope for monetary policy.

LOS 1.h

Central banks often use monetary policy as a countercyclical force. The goal is to keep growth near its long-run sustainable rate because growth faster than the long-run rate usually results in increased inflation. To spur growth, a central bank can take actions to reduce short-term interest rates.

The Taylor rule determines the target interest rate using the neutral rate, expected GDP relative to its long-term trend, and expected inflation relative to its targeted level:

$$i_{\text{target}} = i_{\text{neutral}} + i_{\text{expected}} + [0.5(\text{GDP}_{\text{expected}} - \text{GDP}_{\text{trend}}) + 0.5(i_{\text{expected}} - i_{\text{target}})]$$

- A central bank can use the Taylor rule to determine the appropriate level for short-term interest rates.
- An investment strategist who expects unanticipated changes in the inputs to the Taylor rule can use the rule to anticipate changes in short-term interest rates by the central bank.

Another tool at the government's disposal for managing the economy is fiscal policy. If the government wants to stimulate the economy, it can implement loose fiscal policy by decreasing taxes or increasing spending, thereby increasing the budget deficit. If they want to rein in growth, the government does the opposite to implement fiscal tightening.

LOS 1.i

The yield curve demonstrates the relationship between interest rates and the maturity of debt securities. The curve is sensitive to government actions as well as current and expected economic conditions.

When both fiscal and monetary policies are expansive, the yield curve is sharply upward sloping, which indicates that the economy is likely to expand in the future. When fiscal and monetary policies are restrictive, the yield curve is downward sloping, indicating that the economy is likely to contract in the future.

When fiscal and monetary policies are in disagreement, the shape of the yield curve is less definitively formed. If monetary policy is expansive while fiscal policy is restrictive, the yield curve tends to be upward sloping, though less steep than when both policies are expansive. If monetary policy is restrictive while fiscal policy is expansive, the yield curve tends to be flatter.

LOS 1.j

Macroeconomic links refer to similarities in business cycles across countries. Economies are linked by both international trade and capital flows so that a recession in one country dampens exports and investment in a second country, thereby creating a slowdown in the second country.

Exchange rate links are found when countries peg their currency to others. The benefit of a peg is that currency volatility is reduced and inflation can be brought under control. Interest rates in the pegging country often reflect a risk premium relative to the country to which it pegs.

Interest rate differentials between countries can also reflect differences in economic growth, monetary policy, and fiscal policy.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 1.1

1. The analyst has not been systematic and has used inconsistent assumptions. In this case, the result is overstating the attractiveness of equity and understating the attractiveness of fixed income. The result would be allocating too much to equity. (LOS 1.a)

2. Pro: The recent three-year period is more likely to reflect the current economic and political environment.
Con: The recent shorter period does not reflect the full course of a business cycle or a variety of possible economic conditions.
Pro: The longer period is more likely to reflect various economic conditions that can occur.
Con: The longer period is more likely to be subject to regime change, be nonstationary, and reflect conditions that are no longer relevant.
(LOS 1.b)
3. Some types of alternative investments are not regularly traded, and only infrequent prices (smoothed data) are available. This makes the calculated standard deviation lower because there are no actual periodic changes in value (there are no prices to examine). The smoothed return data also appears to be less correlated with the more erratic pricing of other asset classes that have and report actual trading prices. The correlation will appear closer to zero. (LOS 1.b)

Module Quiz 1.2, 1.3

1. Econometric analysis would be the best approach to use. It can model the complexities of reality using both current and lagged values. Ordinary least squares regression is most often used, but other statistical methods are also available. (Module 1.2, LOS 1.e)
2. C *Early Expansion*: In this period of the business cycle, we expect to observe rising short-term interest rates and stable or rising bond yields.
The expectations of short-term and long-term yields for the other phases are listed as follows:
Late Expansion: Both short-term and long-term rates increase.
Initial Recovery: Low or falling short-term rates, and bond yields have bottomed out. (Module 1.3, LOS 1.f)
3. Bonds tend to perform well during periods of falling inflation or deflation because interest rates are declining. This holds true as long as credit risk does not increase. Equities do poorly in periods of declining inflation or deflation due to declining economic growth and asset prices. (Module 1.3, LOS 1.g)

Module Quiz 1.4

1. Her conclusion may not be warranted. In an economic expansion, the budget deficit will decline naturally because tax receipts increase and disbursements to the unemployed decrease. The changes she is observing may be independent of the government's fiscal policy.
Note that only government-directed changes in fiscal policy influence the growth of the economy. Changes in the deficit that occur naturally over the course of the business cycle are not stimulative or restrictive. (LOS 1.h)

$$\begin{aligned}
 2. \quad n_{\text{target}} &= 2\% + 5\% + [0.5 \times (4\% - 3\%) + 0.5 \times (5\% - 3\%)] \\
 &= 7\% + [0.5\% + 1\%] = 8.5\%
 \end{aligned}$$

In this example, the higher-than-targeted growth rate and higher-than-targeted inflation rate argue for a targeted nominal interest rate of 8.5%. This rate hike is intended to slow down the economy and inflation. (LOS 1.h)

3. If the yield curve is steeply upwardly sloping, then it is likely that both fiscal and monetary policies are expansive. The economy is likely to expand in the future. (LOS 1.i)
4. A global economic slowdown would affect smaller countries with undiversified economies more because economic links are more important for these types of countries. Larger countries with diverse economies are less affected by events in other countries. (LOS 1.j)
5. Greater currency and economic stability: true. The peg is likely to create a more stable currency that provides confidence for investors and business, both of which promote economic stability. Maintaining the peg prevents excessive money creation, which holds down inflation and also promotes economic stability. The peg is a commitment to follow the policies needed to maintain the value of the currency.

Relatively lower and more stable interest rates: partially true (or partially false). Interest rates will be related to but higher than the country to which the currency is pegged. The interest rate premium will reflect the investor's perception of the country's commitment and ability to maintain the peg. If that comes into question, the country will likely have to increase interest rates in order to maintain the currency value. The goal of the peg is lower and more stable rates, but if the peg fails, the opposite can occur.

Pursue the fiscal and economic policies to maximize the country's real economic growth: false. The country must largely follow the economic policies of the country to which it is pegged. These may or may not be optimal for the country's growth. (LOS 1.j)

READING 2

CAPITAL MARKET EXPECTATIONS, PART 2: FORECASTING ASSET CLASS RETURNS

EXAM FOCUS

This reading builds on the preceding capital markets section and expands it for setting expectations for the various asset classes. The section begins with an overview of tools used for forecasting capital market returns. Forecasting the returns of different asset classes is next: fixed income, equities, real estate, and currencies. Make sure you are able to distinguish between risk analysis techniques used for developed and emerging market economies. The final two sections focus on forecasting volatilities, including the variance-covariance matrix, followed by a discussion on how an analyst can make recommendations for adjusting an asset portfolio. Several of the concepts have been consistently tested in past Level III exams, including the Grinold-Kroner and Singer-Terhaar models.

Introduction



PROFESSOR'S NOTE

While this is a longer introduction, it contains necessary information to understand the subsequent sections on forecasting returns. It is also a synthesis of many of the valuation approaches discussed in this reading.

Forecasting returns requires not only assessing expected returns, variances, and correlations, but also understanding that time horizons are important. Investment opportunities, and therefore investment decisions, can change over time. At their core, investment techniques assume that investments tend to return to their fundamental levels over time, known as *central tendency*. There are three approaches to forecasting capital market expectations: formal tools, surveys, and judgments.

Formal Tools

The use of **formal tools** helps the analyst set capital market expectations. When applied to reputable data, formal tools provide forecasts replicable by other analysts. The formal tools we examine are statistical methods, discounted cash flow models, and risk premium models.

Statistical methods involve sample statistics, shrinkage estimation, and time series estimation. Sample statistics use well-known data, including means, variance, and correlation, to forecast future data. This is the clearest approach in forecasting, but it can be imprecise. Alternatively, a *shrinkage estimate* can be applied to the historical estimate if the analyst believes simple historical results do not fully reflect expected future conditions. A shrinkage estimate is a weighted average estimate based on history and some other projection. A *time series estimate* can also

be used to make forecasts. A time series estimate forecasts a variable using lagged values of the same variable and combines it with lagged values of other variables, which allows for incorporating dynamics (volatilities) into the forecasts.

Discounted cash flow models express the intrinsic value of an asset as the present value of future cash flows. The advantage of these models is their correct emphasis on the future cash flows of an asset and the ability to back out a required return.

An alternative to estimating expected return is a **risk premium** or buildup model. Risk premium approaches can be used for both fixed income and equity. The approach starts with a risk-free interest rate and then adds compensation for *priced risks*, or risks for which an investor would want to be compensated. Risk premium models include equilibrium models (e.g., the Capital Asset Pricing Model), a factor model, and building blocks.

Surveys and Judgment

Capital market expectations can also be formed using **surveys**, which can be the most useful ways to gauge consensus. In this method, a poll is taken of market experts, such as economists and analysts, for their opinions regarding the economy or capital market. For example, the U.S. Federal Reserve Bank of Philadelphia conducts an ongoing survey regarding the U.S. consumer price index and GDP.

Judgment can also be applied to project capital market expectations by using qualitative information based on experience. Although quantitative models provide objective numerical forecasts, there are times when an analyst must adjust those expectations using experience and insight to improve upon those forecasts.

MODULE 2.1: FORECASTING FIXED INCOME RETURNS



Video covering this content is available online.

LOS 2.a: Discuss approaches to setting expectations for fixed-income returns.

Forecasting fixed income returns can be done through the **discounted cash flow (DCF) method**, the **risk premium approach**, or the **equilibrium model**. We previously introduced the basics of the DCF and risk premium approaches. The equilibrium approach assumes that supply and demand in global asset markets are in balance.

DCF Analysis

The DCF analysis of fixed income securities is useful when there are known future cash flows, or when cash flows can be estimated reasonably accurately. The DCF analysis supports the use of yield to maturity (YTM) as an estimate of expected return. As you recall, the YTM is the discount rate that makes the present value of future bond cash flows equal to the bond's price. The YTM is an IRR calculation and, like any IRR calculation, it will be the realized return earned if the cash flows are reinvested at the YTM and the bond is held to maturity. For zero-coupon bonds, there are no cash flows to reinvest, though the held-to-maturity assumption still

applies. For bond portfolios, the YTM is the weighted average of the portfolio bonds' individual YTMs, which is generally considered a good approximation.

The assumption of holding the bond to maturity does not factor in optionality, which may result in cash flows not being received as expected. However, even if all expected cash flows are received, there are several reasons why the bond's realized return may deviate from the initial YTM. First, an investor may sell the bond prior to maturity, generating a capital gain or loss. Second, rising or falling interest rates may result in not only changing bond prices, but changing reinvestment returns. For example, falling (rising) interest rates will decrease (increase) reinvestment returns. The overall gain or loss to the investor will depend on the investment horizon. For an investment horizon that is shorter than the Macaulay duration, the capital gain/loss impact will be more dominant than the reinvestment impact, meaning for example that falling (rising) interest rates will result in a higher (lower) realized return. For an investment horizon longer than the Macaulay duration, the reinvestment risk dominates, meaning that falling (rising) interest rates will result in a lower (higher) realized return.

For the Exam: Remember that the Macaulay duration can be calculated from modified duration (i.e., by multiplying modified duration by the bond's YTM).

EXAMPLE: Forecasting bond investment returns

Jordan Turk manages a \$200 million bond portfolio. The portfolio has a YTM of 5.5 and a modified duration of 6.25. Turk has an investment horizon of four years and expects bond yields to fall by 25 bps each year over the investment horizon. Will Turk likely realize a higher or lower overall return than the initial YTM?

Answer:

No detailed calculations are required. The Macaulay duration is 6.6 ($= 6.25 \times 1.055$). Given that the investment horizon (four years) is shorter than the Macaulay duration, a decline in bond yields will result in a realized return that is higher than the YTM because the gain on the bond price will outweigh the decline in reinvestment yield.

The Risk Premium (Building Block) Approach

The building block approach starts with a risk-free rate and then adds compensation for additional risks. The required return will include the one-period default-free rate, a term premium, a credit premium, and a liquidity premium.

1. The short-term default-free rate

The short-term default-free rate matches the forecast horizon and is calculated from the most liquid instrument. As a result, it is closest to the government zero-coupon yield and is closely tied to the central bank policy rate. The observed risk-free rate is typically sufficient as the default-free rate, although it may be necessary to normalize this rate. When the investment horizon is much longer than the maturity of the short-term instrument, alternative approaches may be optimal, either by using the yield of a longer maturity zero-coupon bond, or taking the return that could be realized by rolling over the short-term instrument

over the investment horizon. Futures contract rates provide useful proxies for this expected path of short-term interest rates.

2. *Term premium*

While the rates implied from the spot yield curve gives us useful information about the term premium, the real term premium cannot be derived from the yield curve alone. Empirical evidence suggests that the term premiums are positive and are related to duration. There are four primary drivers of the term premium:

- *Inflation uncertainty*: Higher inflation levels typically correspond to higher inflation uncertainty, causing nominal yields to rise and the term premium to increase.
- *Recession hedge*: When inflation is caused by strong aggregate demand, nominal bond returns are negatively correlated with growth, corresponding to low term premiums. When inflation is caused by aggregate supply, nominal bond returns are positively correlated with growth, corresponding to higher term premiums.
- *Supply and demand*: The relative supply of short- and long-term default-free bonds determines the slope of the yield curve, which influences the level of term premiums.
- *Business cycles*: The slope of the yield curve and level of term premiums are also related to the business cycle.

Other indicators also influence the term premium forecasts:

- *Ex ante* (forecast) real yield.
- *Cochrane and Piazzesi curve factor*: a measure that captures both the slope and curvature of the yield curve.
- *Kim and Wright premium*: a three-factor model of the term structure.
- *Slope of the yield curve*.
- *Supply indicator*: proportion of debt with a maturity greater than 10 years.
- *Cyclical proxies*: corporate profit-to-GDP ratio, business confidence, unemployment rate.

3. *Credit premium*

The credit premium compensates for the expected level of losses and for the risk of default losses, both of which are components of the credit spread.

Empirical evidence suggests that while average yield spreads include a small return premium, the premiums earned tend to be uneven and are subject to significant clustering of persistent high and low default rates. As a result, the yield spread is typically not considered a good predictor of future default rates. Spreads are affected primarily by financial market conditions and the credit premium, but only to a lesser extent by expected default losses. The financial market variables with the strongest predictive power of the credit spread are stock returns, stock volatility, and the risk-free rate, while GDP growth and default rate changes do not have strong predictive capabilities.

Bonds with very high credit quality (AAA and AA) have extremely low default rates, and their credit premium and spreads are mainly driven by *downgrade bias*—this is an asymmetrical risk indicating that a downgrade is more likely than a credit improvement or an upgrade. The credit premium and spreads of low(er)

rated bonds, especially non-investment grade bonds, reflect much higher compensation for credit risk.

Historical evidence for U.S. investment grade corporate bonds suggests that high corporate option-adjusted spreads correspond to a higher credit premium, and steep Treasury curves correspond to declining default rates. Overall, steep yield curves indicate both high credit and term premiums, both of which are bullish indicators because they imply larger compensation for credit losses. However, it is interesting to note that credit premiums are not positively related to maturity. In fact, credit premiums tend to be higher at shorter maturities, possibly due to *event risk* (defaults are large credit negative events, but a bond will not pay more than its face value), and illiquidity (bonds with a short time left to maturity tend to be illiquid older bonds that are not actively traded). To take advantage of these credit features, portfolio managers often use a barbell strategy, in which they take on credit risk from shorter maturity bonds and take duration risk from long maturities.

4. Liquidity premium

Liquidity tends to be the highest at the earliest stages of a bond's life, typically during the first few weeks only. Securities with the highest liquidity are the newest sovereign bond issues, current coupon mortgage-backed securities, and some high quality corporate bonds. As a general rule, liquidity is higher for bonds that are (1) issued at close to par or market rates, (2) new, (3) large in size, (4) issued by a frequent and well-known issuer, (5) simple in structure, and (6) of high credit quality. An analyst could gauge the "true" liquidity premium by comparing the yield spread between the highest quality issuer (usually the sovereign) and the next highest quality issuer. The analyst can then make adjustments to this spread as he moves further away from the features described previously.



MODULE QUIZ 2.1

1. An investor has a bond portfolio with a yield to maturity (YTM) of 4 and a modified duration of 5. The investor expects to hold on to the bond portfolio for at least the next six years but expects that bond yields will gradually rise over the investment horizon by a total of 100 bps. **Determine** whether the investor will realize a higher or lower overall yield than the initial YTM.

Use the following information to answer Questions 2 and 3.

Lou Bee is looking to add two new securities to his fixed income portfolio and considers the following bonds (both noncallable):

- One-year government bond
- Five-year AA rated corporate bond

Bee has also gathered the following information:

Risk-free interest rate (one year)	2.5%
Term premium (five-year vs. one-year government bond)	60 bps
Credit premium (five-year AA corporate bond vs. five-year government bond)	30 bps
Liquidity premium on five-year AA corporate bonds	25 bps

2. The expected return of an equal-weighted investment in the two securities will be *closest* to:
A. 2%.

- B. 3%.
C. 4%.
3. The expected total risk premium of the two securities will be *closest* to:
A. 0.6%.
B. 1.2%.
C. 1.7%.

MODULE 2.2: EMERGING MARKET BOND RISK



Video covering
this content is
available online.

LOS 2.b: Discuss risks faced by investors in emerging market fixed-income securities and the country risk analysis techniques used to evaluate emerging market economies.

Emerging market debt offers the investor high expected returns at the expense of higher risk. Many emerging countries are dependent on foreign borrowing, which can later create crisis situations in their economy, currency, and financial markets.

Many emerging countries also have unstable political and social systems. Their undiversified nature makes them susceptible to volatile capital flows and economic crises. The investor must carefully analyze the risk in these countries. For the bond investor, a significant risk is credit risk—does the country have the ability and willingness to pay back its debt? Economic, political, and legal risks are also important.

Signs that an emerging market is more susceptible to risk include:

- Wealth concentration.
- Income concentration and less diverse tax base.
- Greater dominance of cyclical industries, including commodities and less pricing power.
- Restrictions on capital flows and trade; currency restrictions.
- Inadequate fiscal and monetary policies.
- Poor workforce education and infrastructure and weak technological advancement.
- Large amounts of foreign borrowing in foreign currencies.
- Less developed and smaller financial markets.
- Exposure to volatile capital flows.

There are several guidelines that look at the health of an emerging market. Potential bond investors should look at these factors before committing to invest funds in these markets:

- To gauge fiscal policy, most analysts examine the *deficit-to-GDP ratio*. Ratios greater than 4% indicate substantial credit risk. Most emerging countries borrow short term and must refinance on a periodic basis. A buildup of debt increases the likelihood that the country will not be able to make its payments. The *debt-to-GDP ratio* of 70% to 80% has been troublesome for emerging countries.

- To compensate for the higher risk in these countries, investors should expect a *real growth rate* of at least 4%. Growth rates less than that may indicate that the economy is growing slower.
- A *current account deficit* exceeding 4% of GDP has been a warning sign of potential difficulty.
- Although emerging countries are dependent on foreign financing for growth, too much debt can eventually lead to a financial crisis if foreign capital flees the country. These financial crises are accompanied by currency devaluations and declines in emerging market asset values. *Foreign debt levels* greater than 50% of GDP indicate that the country may be overleveraged. *Debt levels* greater than 200% of the current account receipts also indicate high risk.
- *Foreign exchange reserves* relative to short-term debt is important because many emerging country loans must be paid back in a foreign currency. Foreign exchange reserves less than 100% of short-term debt is a sign of trouble (greater than 200% is considered strong).

The government's stance regarding structural reforms and property rights is important. If the government is supportive of structural reforms necessary for growth, then the investment environment is more hospitable. When the government is committed to responsible fiscal policies, competition, and the privatization of state-owned businesses, there are better prospects for growth. Weak enforcement laws, property rights laws, nationalization of property, and corruption are hazard signs. Coalition governments are also seen as riskier because of the inherent political, and therefore policy, instability.



MODULE QUIZ 2.2

1. An analyst is evaluating an emerging market for potential investment. She notices that the country's current account deficit has been growing. Is this a sign of increasing risk? If so, **explain** why.

MODULE 2.3: FORECASTING EQUITY RETURNS



Video covering this content is available online.

LOS 2.c: Discuss approaches to setting expectations for equity investment market returns.

LOS 2.d: Discuss risks faced by investors in emerging market equity securities.

When looking at a very long time horizon—over 100 years—mean real returns of equity markets in various countries do not show statistically meaningful differences. These sample averages tend to be imprecise, unless the volatility of the data is small. As we saw, shrinkage estimators are typically more reliable as predictors of equity returns.

Discounted Cash Flow Approach

A second tool for setting capital market expectations is **DCF models**. These models say that the intrinsic value of an asset is the present value of future cash flows. The

advantage of these models is their correct emphasis on the future cash flows of an asset and the ability to back out a required return. The models are most suitable for long-term valuation.

Applied to equity markets, the most common application of DCF models is the Gordon growth model, or constant growth model. It is most commonly used to back out the expected return on equity and is often applied to entire markets. In this case, the growth rate is proxied by the nominal growth in GDP, which is the sum of the real growth rate in GDP plus the rate of inflation. The growth rate can be adjusted for any differences between the economy's growth rate and that of the equity index.

Grinold and Kroner (2002) take this model one step further by including a variable that adjusts for stock repurchases—which companies use to transfer cash to shareholders—and changes in market valuations as represented by changes in the price-earnings (P/E) ratio. The **Grinold-Kroner model** states that the expected return of a stock is its dividend yield, plus the inflation rate, plus the real earnings growth rate, minus the change in stock outstanding, plus changes in the P/E ratio:

$$E(R_e) \approx D/P + (\% \Delta E - \% \Delta S) + \% \Delta P/E$$

where:

$E(R_e)$ = expected equity return

D/P = dividend yield

$\% \Delta E$ = expected percentage change in total earnings

$\% \Delta S$ = expected percentage change in shares outstanding

$\% \Delta P/E$ = expected percentage change in the P/E ratio



PROFESSOR'S NOTE

Candidates often get confused by the variable $\% \Delta S$, and when to deduct or add as a number within the GK model.

Remember, a share repurchase is a reduction in shares outstanding, which means the company buys back shares and pays cash to investors. This cash payment is a form of positive return and increases cash flow to investors, EPS, and expected return (mathematically, a share repurchase is a negative $\% \Delta S$ term, so subtracting a negative term becomes a positive number).

The variables of the Grinold-Kroner model can be regrouped into three components: the expected income return, the expected nominal growth in earnings, and the expected repricing return.

1. The **expected cash flow return** (income return):

$$D/P - \% \Delta S = \text{income return}$$

D/P is the current yield as seen in the constant growth dividend discount model. It is the expected dividend expressed as a percentage of the current price. The Grinold-Kroner model goes a step further in expressing the expected current yield by considering any repurchases or new issues of stock.

2. The **expected nominal earnings growth** is the real growth in earnings plus expected inflation:

expected nominal earnings growth return = $\% \Delta E$

3. The **expected repricing return** is captured by the expected change in the P/E ratio:

expected repricing return = $\% \Delta P/E$

It is helpful to view the Grinold-Kroner model as the sum of the (1) expected cash flow return, (2) expected nominal earnings growth rate, and (3) expected repricing return.

$$E(R_e) \approx (D/P - \% \Delta S) + \% \Delta E + \% \Delta P/E$$

It is important to understand that the assumptions of the Grinold-Kroner model may lead to irrational results. Because the model assumes an infinite time horizon, it ignores an investor's time horizon. For example, an investor may assume that the P/E ratio would revert to its long-term average. However, by selecting any positive growth rate for the P/E ratio, the model would assume an infinitely rising P/E ratio, an implausible result. For very long-term time horizons, the theoretically appropriate $\% \Delta P/E = 0$ (and also $\% \Delta S = 0$).

EXAMPLE: Calculating expected equity return using the Grinold-Kroner model

Suppose an analyst uses the Grinold-Kroner model to estimate the stock market return. The analyst estimates a 2.1% dividend yield, real earnings growth of 4.0%, long-term inflation of 3.1%, a 0.5% increase in shares outstanding, and an expansion of the P/E multiple of 0.3%.

What is the implied return on the stock market given these assumptions?

Expected *cash flow* (income) return = dividend yield – increase in shares outstanding

$$= 2.1\% - 0.5\% = 1.6\%$$

Expected nominal earnings growth = real earnings growth + inflation

$$= 4.0\% + 3.1\% = 7.1\%$$

Expected repricing return = change in P/E ratio

$$= 0.3\%$$

The total expected return on the stock market is $1.6\% + 7.1\% + 0.3\% = 9.0\%$.

It is relatively easy to observe the inputs of the model, which can be obtained from published statistical data. It is more challenging to estimate the change in the P/E ratio. The assumption of the P/E ratio (or price relative to other metrics including cash flow or sales) is that it has an observable long-term mean and the ratio will revert to this mean. Empirical evidence suggests that this is true in the long term, but not in the short term.



MODULE QUIZ 2.3

1. At the beginning of the fiscal year, Tel-Pal, Inc. stock sells for \$75 per share. There are 2 million shares outstanding. An analyst predicts that the annual

dividend to be paid in one year will be \$3 per share. The expected inflation rate is 3.5%. The firm plans to issue 40,000 new shares over the year. The price-to-earnings ratio is expected to stay the same, and nominal earnings will increase by 6.8%.

Based upon these figures, **calculate** the expected return on a share of Tel-Pal, Inc. stock in the next year.

2. An analyst uses the Grinold-Kroner model and assumes an infinite time horizon and a P/E growth rate of 2%. **Discuss one** shortcoming of the P/E growth assumption.

MODULE 2.4: THE RISK PREMIUM APPROACH



Video covering this content is available online.

The equity risk premium is generally defined as the amount by which the equity return exceeds the risk-free rate. An alternative way is to think about the equity premium as the amount by which the equity return exceeds the expected return on a default-free bond. Whereas the approach relative to the risk-free rate looks at a single premium for equity, the approach relative to bonds uses a building block approach.

Forecasting the equity premium is generally quite challenging, regardless of the approach selected. An analyst must therefore supplement her forecasts with other methods of analyses.

The Equilibrium Approach

The financial equilibrium approach assumes that financial models will value securities correctly. The **Singer-Terhaar model** is based on two versions of the international *Capital Asset Pricing Model* (CAPM): one in which global asset markets are fully integrated, and another in which markets are fully segmented. The model then looks at the expectations of actual segmentation/integration and takes a weighted average of the two assumptions to calculate returns. The Singer-Terhaar approach begins with the CAPM:

$$R_i = R_f + \beta_{i,M} (R_M - R_f), \text{ or alternatively } RP_i = \beta_{i,M} \times RP_M$$

where:

R_i = expected return on asset i

R_f = risk-free rate of return

$\beta_{i,M}$ = sensitivity (systematic risk) of asset i returns to the global investable market

R_M = expected return on the *global* investable market

RP_i = the asset's risk premium

RP_M = the market's risk premium

Think of the global investable market as consisting of all investable assets, traditional and alternative. We can manipulate this formula to solve for the risk premium on a debt or equity security using the following steps:

$$\text{Step 1: } \beta_{i,M} = \frac{\text{Cov}(R_i, R_M)}{\text{Var}(R_M)} = \rho_{i,M} \left(\frac{\sigma_i}{\sigma_M} \right)$$

where:

$\rho_{i,M}$ = correlation between the returns on asset i and the global market portfolio

σ_i = standard deviation of the returns on asset i

σ_M = standard deviation of the returns on the global market portfolio

$\text{Cov}(R_i, R_m)$ = covariance of asset i return with the global market portfolio return

Step 2: Rearranging the CAPM, we arrive at the expression for the risk premium for asset i , RP_i :

$$RP_i = \beta_{i,M} RP_M = \rho_{i,M} \sigma_i \left(\frac{RP_M}{\sigma_M} \right)$$

This expression states that the risk premium for an asset is equal to the product of its correlation with the global market portfolio and the standard deviation of the asset, multiplied by the Sharpe ratio for the global portfolio (in parentheses). From this formula, we forecast the risk premium and expected return for a market.

EXAMPLE: Calculating equity and bond risk premiums

Given the following data, **calculate** the equity and debt risk premiums for Country X:

	Expected Standard Deviation	Correlation With Global Investable Market
Country X bonds	10%	0.40
Country X equities	15%	0.70
Market Sharpe ratio = 0.35		

Answer:

$$RP_{\text{bonds}} = 10\% \times 0.40 \times 0.35 = 1.40\%$$

$$RP_{\text{equities}} = 15\% \times 0.70 \times 0.35 = 3.68\%$$

The Singer-Terhaar model then adjusts the CAPM for market imperfections, such as segmentation. When markets are segmented, capital does not flow freely across borders. The opposite of segmented markets is integrated markets, where capital flows freely. Government restrictions on investing are a frequent cause of market segmentation. If markets are segmented, two assets with the same risk can have different expected returns because capital cannot flow to the higher return asset. The presence of investment barriers increases the risk premium for securities in segmented markets.

In reality, most markets are neither fully segmented nor fully integrated. Investors have a preference for their own country's equity markets, which prevents them from

fully exploiting investment opportunities overseas. Developed world equity markets have been estimated as 75% to 90% integrated, whereas emerging market equities have been estimated as 50% to 75% integrated. In the example that follows, we will adjust for partial market segmentation by estimating an equity risk premium assuming full integration and an equity risk premium assuming full segmentation, and then taking a weighted average of the two. Under the full segmentation assumption, the relevant global portfolio is the individual asset as its own market portfolio, meaning that the asset is perfectly correlated with itself ($\beta_{i,M} = \rho_{i,M} = 1$).

Step 3: Calculate the risk premium for asset i assuming a fully segmented market:

$$\text{if } \rho_{i,M} = 1 \rightarrow RP_i^S = \sigma_i \left(\frac{RP_i^S}{\sigma_i} \right)$$

If no local market Sharpe ratio is given, then use the global market Sharpe ratio.

Step 4: The last piece is to take a weighted average of the two risk premiums (calculated under full integration and full segmentation) to calculate the asset's risk premium:

$$RP = \phi RP^G + (1 - \phi) RP^S$$

where ϕ measures the degree of the asset's integration with the global markets, and the superscripts are G (globally integrated) and S (segmented).

EXAMPLE: Calculating the risk premium using the Singer-Terhaar model

Suppose an analyst is valuing two equity markets. Market A is a developed market, and Market B is an emerging market. The investor's time horizon is five years. The other pertinent facts are as follows:

	Market A	Market B
Sharpe ratio	0.29	0.40
Volatility (standard deviation)	17%	28%
Correlation with global market	0.82	0.63
Degree of integration	80%	65%
Illiquidity premium	0%	2.3%
Risk-free rate is 5.0%		
Sharpe ratio of the global market is 0.29		

Calculate the risk premiums and expected returns for each market.

Answer:

First, we calculate the risk premium for both markets assuming full integration. Note that for the emerging market, the illiquidity risk premium is included:

$$RP_i = \rho_{i,M} \sigma_i (\text{market Sharpe ratio})$$

$$RP_A = (0.82)(0.17)(0.29) = 4.04\%$$

$$RP_B = (0.63)(0.28)(0.29) + 0.0230 = 7.42\%$$

Next, we calculate the equity risk premium for both markets assuming full segmentation:

$$RP_i = \sigma_i(\text{market Sharpe ratio})$$

$$RP_A = (0.17)(0.29) = 4.93\%$$

$$RP_B = (0.28)(0.40) + 0.0230 = 13.50\%$$

Note that when we calculate the risk premium under full segmentation, we use the local market as the reference market instead of the global market and thus, the correlation between the local market and itself is 1.0.

We then take a weighted average of the integrated and segmented risk premiums by the degree of integration and segmentation in each market to arrive at the weighted average risk premium:

$$RP_i = (\text{degree of integration of } i)(\text{ERP assuming full integration}) + (\text{degree of segmentation of } i)(\text{ERP assuming full segmentation})$$

$$RP_A = (0.80)(0.0404) + (1 - 0.80)(0.0493) = 4.22\%$$

$$RP_B = (0.65)(0.0742) + (1 - 0.65)(0.1350) = 9.55\%$$

Finally, the expected return in each market also incorporates the risk-free rate:

$$\hat{R}_A = 5\% + 4.22\% = 9.22\%$$

$$\hat{R}_B = 5\% + 9.55\% = 14.55\%$$

Emerging Market Equity Risk

Emerging markets are often characterized by fragile economies, political and policy instability, and weaker legal protections, including weak property rights, and weak disclosure and enforcement standards. They tend to exhibit idiosyncratic risks where local country effects tend to be more important than global effects. Emerging markets tend to be less fully integrated than developed markets.



MODULE QUIZ 2.4

Use the following data to answer the questions below:

Sharpe ratio of the global portfolio	0.29
Standard deviation of the global portfolio	8.0%
Risk-free rate of return	4.5%
Degree of market integration for Market A	80%
Degree of market integration for Market B	65%
Standard deviation of Market A	18%
Standard deviation of Market B	26%
Correlation of Market A with global portfolio	0.87
Correlation of Market B with global portfolio	0.63

1. **Calculate** the risk premiums for Market A and Market B.
2. **Calculate** the expected return for each market.

MODULE 2.5: FORECASTING REAL ESTATE RETURNS



Video covering this content is available online.

LOS 2.e: Explain how economic and competitive factors can affect expectations for real estate investment markets and sector returns.

Unlike traditional asset classes (think equities, bonds, and cash or cash equivalents), real estate is generally immobile and illiquid, and each property is part of a heterogeneous group with its unique characteristics. Managing real estate also requires maintenance and, therefore, operating costs can be significant. Calculating returns is often done through appraisals, which are subject to time lags and data smoothing given that they are done infrequently, so appraised values may differ significantly from market values.

Real Estate Cycles

As a general asset class, real estate values are subject to business cycle movements, but they also drive business cycles. Given that supply is fixed at any given point in time, property values exhibit *cyclical*ity, and demand will be strongly influenced by the quality and type of property available. High quality properties tend to fluctuate less with business cycles, while low quality properties will show more cyclical^{ity}. When looking at real estate and business cycles, we observe the following characteristics:

- **Boom:** Increased demand will drive up property values and lease rates, which induces construction activity. This higher activity translates to stronger economic activity.
- **Bust:** Falling demand leads to overcapacity and overbuilding, driving values and lease rates down. Because leases lock in tenants for longer terms and moving costs are high, excess supply can't be quickly absorbed.

A recent study suggests that the U.S. commercial real estate collapse following the global financial crisis was caused by leverage and speculation rather than business cycle movements.

Capitalization Rates

The **capitalization rate**, or **cap rate** for short, is a commercial real estate property's earnings yield, and is calculated by dividing current **net operating income (NOI)** by the property value. The cap rate is similar to the denominator of the Gordon Growth model, looking at expected return less the NOI growth rate. When an infinite time period is assumed, the cap rate can be calculated as:

$$\text{cap rate} = E(R_{re}) - \text{NOI growth rate}$$

$$E(R_{re}) = \text{cap rate} + \text{NOI growth rate}$$

During stable periods, the long-run NOI growth rate should be close to GDP growth. If an investor has a finite time period, the formula changes by subtracting from expected return the change in the cap rate:

$$E(R_{re}) = \text{cap rate} + \text{NOI growth rate} - \% \Delta \text{cap rate}$$

As you likely observed, this formula has similarities with the Grinold-Kroner model, noting that NOI growth is also a nominal measure, incorporating real growth plus

inflation.

The cap rate is quite sensitive to competitive pressures. With the rapid growth of online retailers, the difference in the cap rates of malls in the United States with high and low productivity grew from 1.2% in 2008 to 3.2% in 2018.

Similar to the expected return net of growth rate for equities, the cap rate is used as a long-term measure of risk discount rate for real estate property valuations. Hence, cap rates are positively related to changes in interest rates and vacancy rates. Lenders are less willing to extend credit due to perceived higher risk resulting in cap rates that are inversely related to the availability of credit and the availability of debt financing. Credit spreads, which are countercyclical, mitigate the cyclical sensitivity of cap rates.

Risk Premiums on Real Estate

Real estate assets require several risk premiums to compensate for their higher risk. These include a term premium for holding long-term assets, a credit premium to compensate for the risk of tenant nonpayment, and an equity risk premium above corporate bond returns for the fluctuation in real estate values, leases, and vacancies. Overall, the combined risk premium is higher than that of corporate bonds but lower than equities.

Liquidity risk is also important for real estate. For publicly traded real estate, including REITs, the liquidity risk is the risk that the asset cannot be sold quickly at a reasonable price. For real estate as an asset group, liquidity risk reflects an inability to sell the asset except at periodic times. The liquidity premium is considered to be between 2% and 4% for commercial real estate.

Once the appropriate risk premiums are calculated, real estate can be used in equilibrium models including Singer-Terhaar. However, analysts must make two adjustments: the impact of smoothing must be removed from the data, and the analyst should adjust for illiquidity by incorporating a liquidity premium. The local, rather than global, nature of real estate should also be considered.

Public vs. Private Real Estate

Wealthy individuals and large institutional investors can create diversified real estate portfolios. Investors with less wealth can choose publicly traded real estate, including REITs, to benefit from diversification. REITs are generally strongly correlated with equities in the short term, while direct real estate shows low correlation. However, the low correlation is partly due to the smoothing of return data. Over long time horizons, REITs have a relatively high correlation with direct real estate.

Given that REITs use significant leverage, their returns and risks must be first unlevered to provide the appropriate comparison with direct real estate holdings. When adjusted for leverage, REITs as an asset class historically show higher returns and lower volatility than direct real estate. This difference may be due to investors capturing much of the liquidity risk premium of direct investments, while also profiting from professional management.

However, there are significant differences between apartment, office, industrial and retail classes. Retail REITs had the highest return and second lowest volatility. Industrial REITs had the lowest return and highest volatility. Within directly owned real estate, apartments had the highest return while office had the lowest.

Residential Real Estate Returns

Residential real estate is the largest class of developed properties, accounting for 75% of global values. Overall, residential real estate outperformed equities on an inflation-adjusted basis with lower volatility. Nevertheless, their return performance differed before and after World War II, with relatively weaker postwar returns. The strongest postwar period returns were during 1950–1980 when residential real estate generally outperformed equities, but had comparably weaker returns during 1980–2015. However, and important for diversification, residential real estate returns were uncorrelated across countries after the war, while equity returns showed rising correlations.



MODULE QUIZ 2.5

1. **List** *two* adjustments that analysts must make to the risk premiums calculated using equilibrium models.
2. **Discuss** how cap rates are related to vacancy rates and the availability of debt financing.

MODULE 2.6: EXCHANGE RATE FORECASTING



Video covering this content is available online.

LOS 2.f: Discuss major approaches to forecasting exchange rates.

Currency exchange rate forecasting is particularly difficult, causing investment managers to either fully hedge currency exposure, or accept the volatility. Currencies are units of account in which asset prices are quoted. Movements in exchange rates change the value of all assets denominated in one currency relatively to all other currencies. Exchange rates are determined by factors influenced by trading, governments, financial systems, and geographies, as well as by laws, regulations, and customs of a country.

Trade in goods and services affects exchange rates through (1) trade flows, (2) purchasing power parity, and (3) competitiveness and sustainability of the current account.

- **Trade flows:** The impact of net trade flows (gross trade flows less exports) tends to be relatively small on exchange rates assuming they can be financed. Large trade flows without large financing flows in foreign exchange markets likely indicates a crisis.
- **Purchasing power parity (PPP):** PPP implies that the prices of goods and services in different countries should reflect changes in exchange rates. As a result, the expected exchange rate movement should follow the expected inflation rate

differentials. Furthermore, the expected change in real exchange rates should be zero, if real exchange rates are the ratio of price levels converted through a common exchange rate. PPP does not work well in explaining short-term exchange rate changes, but works better in the long term and when inflation differences are large and are determined through money supply.

Actual real exchange rates may differ from those predicted through PPP. For example, there could be trade barriers or certain goods may not be traded. PPP does not account for capital flows, which may exert significant influence on exchange rates. Exchange rates may also be influenced by economic development independent of PPP.

- *Current account and exchange rates:* When restrictions are placed on capital flows, exchange rate sensitivity tends to increase relative to the current account (trade) balance. Current account balances will have the largest influence on exchange rates when they are persistent and sustained. However, it is not the size of the current account balance that matters as much as the length of the imbalance.

Structural imbalances in the current account can exist from (1) fiscal imbalances that persist over time, (2) demographics and trade preferences that impact savings decisions, (2) how abundant or scarce resources are, (4) availability (or lack) of viable investment opportunities, and (5) the terms of trade.

Adjustments to capital flows will place substantial pressure on exchange rates. Three important considerations to look at are the implications on capital mobility, uncovered interest rate parity, and portfolio balances and compositions.

1. *Capital mobility:* The expected percentage change in the exchange rate can be computed as the difference between nominal short-term interest rates and the risk premiums of the domestic portfolio over the foreign portfolio:

$$E(\% \Delta S_{d/f}) = (r^d - r^f) + (\text{Term}^d - \text{Term}^f) + (\text{Credit}^d - \text{Credit}^f) + (\text{Equity}^d - \text{Equity}^f) + (\text{Liquid}^d - \text{Liquid}^f)$$

When there is a relative improvement in investment opportunities in a country, the currency initially tends to see significant appreciation but “overshoots” and eventually depreciates. There are three phases of the response to stronger investment opportunities: (1) the exchange rate will initially significantly appreciate, (2) following an extended level of stronger exchange rates in the intermediate term, investors will start to expect a reversal, and (3) the exchange rate in the long run will tend to start reverting (depreciate) once the investment opportunities have been realized. The third phase is shown in the equation above with a positive $E(\% \Delta S_{d/f})$, indicating the domestic currency will depreciate by that amount in percent.

2. *Uncovered interest rate parity (UIP):* UIP states that exchange rate changes should equal differences in nominal interest rates. UIP implies that in the previous equation, only the interest rate differential matters and not the premium differentials. In contrast to UIP, *carry trades* involve borrowing in a low-rate currency and lending in a high-rate currency. Carry trades are considered to be successful because they include a risk premium, confirming the validity of the risk premiums in the equation.

When capital flows into a country given exchange rate differentials, this is referred to as *hot money*. Hot money creates monetary policy issues. First, central banks' ability to use monetary policy effectively is limited. Second, firms use short-term financing to fund long-term investments, which increases financial market risk. Third, exchange rates tend to overshoot, creating business disruption. Central banks may try to counter the effects of hot money flows through intervention in the currency markets, including selling government securities or maintaining interest rate targets.

3. *Portfolio balance and composition*: Strong economic growth in a country tends to correspond to an increasing share of that country's currency in the global market portfolio. Investors need to be induced to increase their allocations to that country and currency, which weakens the currency and increases the risk premiums. However, a few factors could mitigate this impact:

- Investors tend to have a strong home country bias, which leads them to absorb a larger share of the new assets.
- If growth is due to productivity gains, investors may fund it with financial flows and foreign direct investment.
- Countries that experience high trend rates tend to be smaller, emerging markets. Increasing the weight in these countries generally does not weaken their currency.

Similarly, large current account deficits also weaken exchange rates, but several mitigating factors exist:

- Current account deficits due to large investment spending are easier to finance if they are expected to be profitable.
- Small current account deficits in global reserve currencies, including the U.S. dollar, help provide global liquidity and are beneficial to the financial system.



MODULE QUIZ 2.6

1. Assume that Japanese inflation is projected to be a cumulative 8.2% over the next five years, while U.S. inflation is 13.2% over the same period. U.S. inflation is thus projected to be 5% higher. Stock prices have just started to rise and will continue to do so for some time. **Explain** which asset class should an investor in Japanese assets favor assuming PPP holds true.

MODULE 2.7: VOLATILITY FORECASTING



LOS 2.g: Discuss methods of forecasting volatility.

Video covering this content is available online.

Estimating the variance for a single asset is relatively easy. Estimating variances for many assets is more complex, and requires the use of a **variance-covariance (VCV) matrix** or other forecasting tools.

The VCV Matrix

Sample VCV Matrix

Estimating a constant VCV matrix can most easily be done from deriving variances and covariances from sample statistics. However, choosing the appropriate sample size for large portfolios will be critical. If the sample size is small relative to the number of assets (i.e., the number of assets cannot exceed the number of historical observations), the outcomes may be meaningless; for example, it may show that a large portfolio is riskless. It is recommended that the number of observations should be at least 10 times larger than the number of portfolio assets.



PROFESSOR'S NOTE

There are a large number of formulas in this section. They are included primarily to explain the underlying concepts, but it is unlikely that you would be required to do these calculations on the exam. The LOS only asks you to *discuss* methods of volatility forecasts.

Factor-Based VCV Matrices

The main advantage of using multifactor models for VCV matrices is that it significantly reduces the number of required observations. Correlations can be estimated from a few common factors, while variances require factors related to specific assets.

The return of the i th asset in a multifactor model can be calculated as:

$$r_i = \alpha_i + \sum_{k=1}^K \beta_{ik} F_k + \varepsilon_i$$

where K represents the number of common factors, α_i is the intercept, β_{ik} is the i th asset's sensitivity to the k th factor, F_k is the k th factor return, and ε_i is a factor term unique to asset i with a zero mean.

The variance of the i th asset can be derived as:

$$\sigma_i^2 = \sum_{m=1}^K \sum_{n=1}^K \beta_{im} \beta_{in} \rho_{mn} + \nu_i^2$$

where ρ_{mn} is the covariance between the m th and n th factors, and ν_i^2 is the variance of the ε_i unique factor.

The last step is to look at the covariance between the i th and j th asset:

$$\sigma_{ij} = \sum_{m=1}^K \sum_{n=1}^K \beta_{im} \beta_{jn} \rho_{mn}$$

Assuming these factors are not redundant and do not have zero terms will help us ensure that the matrix outcomes are not meaningless and that portfolios do not incorrectly appear riskless.

The factor model also helps simplify the number of calculations used in the VCV matrix. For example, whereas the VCV matrix would need $(N(N-1)/2)$ covariances, the factor model would need only $(N \times K)$ factor sensitivities and $(K(K+1)/2)$ factor elements. For $N = 50$ and $K = 6$, the VCV matrix would need $(50(49)/2) = 1,225$ sensitivities, whereas the factor model would need only $(50 \times 6) = 300$ sensitivities and $(6 \times 7/2) = 21$ elements.

Despite their significant advantages, factor-based VCV matrices have several shortcomings:

1. The matrix is *biased*: Matrix inputs need to be estimated and will be misspecified. As a result, the matrix will be biased, meaning it will not be a predictor of the true returns, not even on average.
2. The matrix is *inconsistent*: As the sample size increases in the factor-based VCV matrix, the model does not converge to the true matrix. In contrast, the sample VCV matrix will be both consistent and unbiased.

Shrinkage Estimates

Combining information in the sample VCV matrix with a target matrix (e.g., the factor-based VCV matrix) will result in more precise data and reduced estimation error. The shrinkage estimate is a weighted average estimate of the sample and target (e.g., factor-based) matrix, with the same weights used for all elements of the matrix, including the variance and covariance factors. The resulting figures will be more efficient because they will have smaller error terms. Even though shrinkage estimates may be biased, more precise (less biased) target matrices will result in greater improvement.

For example, suppose that the sample covariance between two assets is 180 and the target (from a factor-based model) estimated covariance is 220. If the analyst weights the historical covariance by 60% and the target by 40%, the shrinkage estimate would be 196 ($= 180 \times 0.60 + 220 \times 0.40$). If conditions of the model and weights are well chosen, the shrinkage estimate covariances are likely to be more accurate.

Smoothed Returns to Estimate Volatility

Smoothing of data leads to underestimating risk and overstating returns and diversification benefits. Not adjusting for smoothing tends to lead to distorted portfolio analysis and suboptimal asset allocation decisions. As a result, it is important that analysts adjust the data for the impact of smoothing, by taking a weighted average of the current “true” returns and previously observed returns:

$$R_t = (1 - \lambda)r_1 + \lambda R_{t-1} \text{ where } \lambda \text{ is a weight between 0 and 1}$$

The portfolio variance is then calculated as:

$$\text{var}(r) = \left(\frac{1 + \lambda}{1 - \lambda} \right) \text{var}(R) > \text{var}(R)$$

For example, if $\lambda = 0.6$, then the true variance is $1.6 / 0.4 = 4 \times$ the variance and $2 \times$ the standard deviation of the observed data.

One shortcoming of this model is that the true current return is not directly observable. Proxies for estimating the true return include using an asset index.

ARCH Models



PROFESSOR'S NOTE

You previously encountered the concept of ARCH in Level II. Use that knowledge to your advantage.

Asset returns generally show periods of high and low volatilities, leading to **volatility clustering**. These volatilities can be addressed through autoregressive conditional heteroskedasticity (ARCH) models. ARCH models can be used for portfolios with multiple assets in VCV matrix estimations. The simplest ARCH formula can be written as:

$$\sigma_t^2 = \gamma + \alpha\sigma_{t-1}^2 + \beta\eta_t^2 = \gamma + (\alpha + \beta)\sigma_{t-1}^2 + \beta(\eta_t^2 - \sigma_{t-1}^2)$$

where α , β , and γ are nonnegative parameters and $(\alpha + \beta) < 1$, and η_t is a random variable indicating the unexpected return component.

Higher $\alpha + \beta$ terms indicate higher emphasis on past information, leading to volatility clustering.



MODULE QUIZ 2.7

1. A portfolio manager determines that in order to estimate the variance-covariance matrix used in the portfolio's asset allocation, the matrix will need 17 asset classes. The manager has obtained weekly sample return data over the last 6 months. The manager decided to also use the factor-based matrix approach, but does not use shrinkage estimation. **Determine** the strengths and shortcomings of the manager's approach.
2. **Discuss** one potential remedy to the manager's shortcomings.

MODULE 2.8: GLOBAL PORTFOLIO ADJUSTMENTS

LOS 2.h: Recommend and justify changes in the component weights of a global investment portfolio based on trends and expected changes in macroeconomic factors.

For the Exam: This LOS asks you to use much of what you have learned here and apply it to portfolio management. Given that the emphasis of the Level III exam is portfolio management, you need to be able to pull all this material together.

In this section, we apply what we have learned so far to adjust portfolio allocations. The main focus here is *how* to adjust a portfolio rather than get caught up in the particular forecast details. For example, if the starting point is a typical portfolio of equities and bonds, we may want to consider changing the weighting between equities and bonds, changing the weights between domestic and international investments, or adjusting the credit quality, duration, yield curve positioning or currency exposures of the underlying assets. To aid this decision-making process, it is helpful to keep in mind the following questions:

- Have the drivers of trend growth changed significantly?
- Are markets becoming more or less integrated?
- Where is the country positioned within the business cycle, and are fiscal and monetary policies consistent with the business cycle phase?
- What is the trend in current account balances?

- Are currencies strong or weak, and how are currencies affecting economic growth and competitiveness?

Trend growth is generally favorable to equities because it implies long-term earnings growth. Trend growth is unfavorable to bonds because it typically results in higher interest rates. The analyst can use country-specific and global expectations through VCV matrices to adjust the allocations between equities and bonds.

As markets become more integrated globally, required returns will fall. We saw this relationship in the Singer-Terhaar model. The analyst should increase allocations towards emerging markets that are expected to see increased integration, and away from those markets that are already highly integrated.

When the economy is at the *trough* of the business cycle, equities perform well, and valuation ratios and earnings growth are expected to increase. The analyst could also use the Grinold-Kroner model to compute the required equity risk premium and increase the portfolio's equity weights. At this stage, the yield curve is steep with high credit and term premiums. However, the expectation of rising interest rates means that bonds tend to underperform, and the analyst should reduce the portfolio's bond allocation. The overall bond duration should also be reduced, and a barbell strategy may be optimal (increased short-term and long-term exposure and reduced medium-term exposure). If the economy is at its peak, the reverse strategy should be followed (i.e., reduce the equity exposure and increase bond exposure and durations).

Monetary and fiscal policy changes can also be important considerations. The analyst should focus less on monetary and fiscal policy activities, which are expected to be already reflected in asset values, but rather on structural changes in policy direction. For example, changes in the tax code or changes from standard interest rate targeting to other policies, including quantitative easing, can influence the direction of portfolio reallocation changes.

Current account balances fluctuate with business cycles. It is the long-term trend in current account balances that is more important in setting portfolio expectations. Rising current account deficits tend to be associated with rising required returns (and therefore falling asset prices), and increased capital flows to the deficit country to fund its deficit. Capital flows also influence currencies. If assets in a particular currency offer higher risk-adjusted return potential than in other currencies, capital will flow to that country and put upward pressure on its currency. The analyst will need to determine whether the currency still has potential to appreciate, or whether it is at its peak.



MODULE QUIZ 2.8

A portfolio manager has a global portfolio invested in several countries and is considering other countries as well. The decisions the manager faces and the economic conditions in the countries are described in the following. In each case, the portfolio manager must reallocate assets based on economic conditions.

1. The portfolio manager has noticed that the yield curve is downward sloping in Country A. The current portfolio in this country is 60% stocks and 40% bonds.
Determine the appropriate reallocation within Country A. **Suggest** changes to the portfolio based on this information.

2. Country B has experienced declining prices and this trend is expected to continue. The manager has no funds invested in this country yet but is considering investments in bonds, equity, and real estate.

Determine the appropriate reallocation within Country B. In which assets should the manager invest?

3. The manager is considering the purchase of government bonds in either emerging Country C or Country D. The countries have the following characteristics:

Characteristics of Countries C and D

	Country C	Country D
Foreign exchange/short-term debt	147%	78%
Debt to GDP	42%	84%

Determine the appropriate reallocations within emerging Country C and Country D.

KEY CONCEPTS

LOS 2.a

The three approaches to forecast fixed income returns are the DCF method, the risk premium approach, and the equilibrium model.

The DCF method is used to estimate the required return of an asset. It is the most precise method for fixed income securities. It includes analysis of the YTM and the Macaulay duration. The Macaulay duration will determine whether an expected yield change will generate positive or negative returns (by looking at its impact on prices vs. return from reinvestment of cash flow).

The risk premium (or building block) approach starts with the risk-free rate and adds on different risk premiums, including the term premium, credit premium, and liquidity premium.

The short-term risk-free rate can be estimated from government zero-coupon yields. The term premium is positively related to duration and the slope of the yield curve, and is influenced by inflation uncertainty, recession hedges, supply and demand of bonds, and business cycle movements.

Credit premiums compensate for the expected level of losses and for the risk of default losses, and are also positively related to the slope of the yield curve.

Steep yield curves generally indicate both high credit and term premiums, both of which are considered bullish indicators.

Liquidity tends to be highest for bonds that are (1) issued at close to par or market rates, (2) new, (3) large in size, (4) issued by a frequent and well-known issuer, (5) simple in structure, and (6) of high credit quality. Liquidity premiums can be established by comparing the yield spread between the highest quality issuer (usually the sovereign) and the next highest quality issuer.

LOS 2.b

Investors in emerging market debt face higher risks associated with the foreign government's ability and willingness to repay its obligations, and are exposed to other political, legal, and economic risks.

Indicators of heightened credit risk in emerging market bonds include (1) deficit-to-GDP ratio greater than 4%; (2) debt-to-GDP ratio greater than 70%–80%; (3) real

growth rate less than 4%; (4) a current account deficit exceeding 4% of GDP; (5) foreign debt levels greater than 50% of GDP or debt levels greater than 200% of the current account receipts; and (6) foreign exchange reserves less than 100% of short-term debt.

LOS 2.c

Equity market returns can be estimated using the DCF analysis, a risk premium approach, and the equilibrium approach.

The DCF analysis can also be used for equity valuation and establish the intrinsic value of an asset as the present value of its future cash flows.

The Grinold-Kroner model calculates the expected equity return as its dividend yield plus the inflation rate plus the real earnings growth rate minus the change in stock outstanding plus changes in the P/E ratio.

The Grinold-Kroner model can also be viewed as the (1) expected cash flow return (dividend yield minus change in shares outstanding), (2) nominal earnings growth (real earnings growth plus inflation), and (3) expected repricing return (change in the P/E ratio).

The risk premium approach looks at the equity risk premium as the amount by which the equity return exceeds the expected return of a default-free bond. However, forecasting the equity premium can be challenging.

The Singer-Terhaar model combines two versions of the international CAPM: one in which global asset markets are fully integrated and another in which markets are fully segmented.

The Singer-Terhaar model calculates the risk premium for an asset in a fully integrated market as the product of its correlation with the global market portfolio and the standard deviation of the asset, multiplied by the Sharpe ratio of the global portfolio. The model calculates the risk premium for an asset in a fully segmented market as the product of the standard deviation of the asset and its Sharpe ratio plus any illiquidity premium.

The Singer-Terhaar model then calculate the asset's overall risk premium as the weighted average of the risk premiums calculated under full integration and full segmentation.

LOS 2.d

Emerging equity markets tend to be characterized by political and policy instability, weaker legal protections, and weak disclosure and enforcement standards. Emerging markets tend to be more segmented than developed markets.

LOS 2.e

Real estate values are subject to business cycle movements, including boom (higher demand drives up property values) and bust (falling demand drives values and lease rates down).

Real estate valuation is measured by the cap rate, which is calculated by dividing current NOI by the value of a commercial real estate property.

Real estate returns include a term premium for holding long-term assets, a credit premium to compensate for the risk of tenant nonpayment, and an equity risk

premium above corporate bond returns for the fluctuation in real estate values, leases, and vacancies.

REITs are generally strongly correlated with equities in the short term, while direct real estate shows low correlation, although the low correlation is partly due to the smoothing of return data.

Over the very long run, residential real estate outperformed equities on a real basis with lower volatility, although their return has been relatively weak over the last 40 years.

LOS 2.f

Trade in goods and services affects exchange rates through trade flows, purchasing power parity (PPP), and competitiveness and sustainability of the current account.

Net trade flows have small impacts on exchange rates; large trade flows without large financing flows in foreign exchange markets likely indicate a crisis. PPP does not work well in explaining short-term exchange rate changes but works better in the long term and when inflation differences are large and are determined through changes in the money supply. Current account balances will have the largest influence on exchange rate when they are persistent and sustained.

Adjustments to capital flows place substantial pressure on exchange rates. Three important considerations include the implications on capital mobility, UIP, and portfolio balances and compositions.

Under ideal capital mobility conditions, the expected percentage exchange rate change will equal the “excess” risk-adjusted expected portfolio return denominated in the domestic currency relative to the foreign currency. However, the exchange rate may overshoot in the short run, which results from hot money chasing higher returns.

Carry trades tend to be profitable, but this contradicts the assumptions of UIP, which states that exchange rate changes should equal differences in nominal interest rates.

Looking at the portfolio balance and composition, exchange rates tend to adjust given changes in the relative sizes and compositions of the aggregate portfolios denominated in each currency.

LOS 2.g

A sample variance-covariance matrix is a popular tool to estimate the true VCV structure. Problems with the sample VCV matrix is that it cannot be used for large numbers of asset classes and it is subject to sampling error.

Factor-based (multifactor) models allow the VCV matrix to handle large numbers of asset classes. However, the factor-based VCV matrix is biased and inconsistent.

The shrinkage estimate is a weighted average estimate of the sample and target (e.g., factor-based) matrix, with the same weights used for all elements of the matrix.

Smoothing of data leads to underestimating risk and overstating returns and diversification benefits. Not adjusting for smoothing tends to lead to distorted portfolio analysis and suboptimal asset allocation decisions.

ARCH models can be used for portfolios with multiple assets to address volatility clustering of financial asset returns.

LOS 2.h

Be able to discuss how the relationships covered in the previous LOS can be used in assessing the relative attractiveness of asset classes (i.e., estimating expected return and risk through the VCV matrices, using the Singer-Terhaar model or the Grinold-Kroner model, phases of the business cycle, capital flows, and expectations of currency movements).

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 2.1

1. The investor will realize a gain. The portfolio's Macaulay duration is 5.2 ($= 5 \times 1.04$). Given that the investor's investment horizon of six years is longer than the Macaulay duration, a rise in bond yields will result in a return that is higher than the YTM because the increase in reinvestment yield will outweigh the fall in the bond price. (LOS 2.a)
2. **B** The expected annual return of the one-year government bond is 2.5% (no risk premiums). The expected one-year return of the corporate bond is 3.65% ($= 2.5\% + 0.6\% + 0.3\% + 0.25\%$). The estimated weighted average return of an equal-weighted investment in the two securities is 3.08% ($= (2.5\% + 3.65\%) / 2$). (LOS 2.a)
3. **A** The average spread (vs. one-year government bond) is 0.58% ($= [0 + (0.6 + 0.3 + 0.25)] / 2$). (LOS 2.a)

Module Quiz 2.2

1. When exports are less than imports, a current account deficit usually results. This can be problematic because the deficit must be financed through external borrowing. If the emerging country becomes overleveraged, it may not be able to pay back its foreign debt. A financial crisis may ensue where foreign investors quickly withdraw their capital. These financial crises are accompanied by currency devaluations and declines in emerging market asset values. (LOS 2.b)

Module Quiz 2.3

1. The equation for expected return on Tel-Pal, Inc. using these inputs is:

$$E(R_e) \approx D/P + (\% \Delta E - \% \Delta S) + \% \Delta P/E$$

$$\hat{R}_T = \left(\frac{\$3}{\$75} \times 100 \right) + 6.8\% - 2\% + 0 = 8.8\%$$

The expected return is 8.8%. The expected dividend yield is 4%, and the expected percentage increase in the number of shares is 2% ($= 40,000 / 2,000,000$). Nominal earnings of 6.8% includes expected inflation of 3.5%, which would be subtracted from the nominal earnings forecast to get the forecast of

real earnings growth of 3.3%. The change in P/E is expected to stay the same for a value of 0. (LOS 2.c)

2. An infinite time horizon ignores the fact that the P/E ratio would likely revert to its long-term average. A 2% constant growth rate of the P/E ratio would result in an infinitely rising P/E ratio, which is considered an implausible outcome. (LOS 2.c)

Module Quiz 2.4

1. First, we calculate the risk premium assuming full integration.

$$RP_i = \rho_{i,M} \sigma_i (\text{market Sharpe ratio})$$

$$RP_A = (0.87 \times 0.18 \times 0.29) = 4.54\%$$

$$RP_B = (0.63 \times 0.26 \times 0.29) = 4.75\%$$

Then, we calculate the risk premium assuming full segmentation.

$$RP_i = \sigma_i \left(\frac{RP_M}{\sigma_M} \right)$$

$$RP_A = (0.18 \times 0.29) = 5.22\%$$

$$RP_B = (0.26 \times 0.29) = 7.54\%$$

Finally, weight the integrated and segmented risk premiums by the degree of integration and segmentation:

$$RP_A = (0.80 \times 0.0454) + [(1 - 0.80) \times 0.0522] = 4.68\%$$

$$RP_B = (0.65 \times 0.0475) + [(1 - 0.65) \times 0.0754] = 5.73\%$$

(LOS 2.c)

2. The expected return in each market is then:

$$R_A = 4.68\% + 4.50\% = 9.18\%$$

$$R_B = 5.73\% + 4.50\% = 10.23\%$$

(LOS 2.c)

Module Quiz 2.5

1. Once an analyst estimates the risk premiums using equilibrium models, the analyst should (1) remove the impact of smoothing from the data, and (2) adjust for illiquidity using a liquidity premium. (LOS 2.e)
2. Cap rates are positively related to changes in interest rates and vacancy rates. They are inversely related to the availability of credit and the availability of debt financing. (LOS 2.e)

Module Quiz 2.6

1. The PPP relationship states that countries with high inflation will see their currency depreciate, so the manager should invest in Japan. Within Japan, the investor should invest in stocks because stock prices have just started to rise and will continue to do so for some time. Bond yields will soon rise and their prices will fall as the economy expands. (LOS 2.f)

Module Quiz 2.7

1. The manager can use the sample VCV matrix because the sample size (26 weeks) exceeds the number of assets (17). However, this will be subject to large sample errors unless the number of observations is at least 10 times the number of assets. This condition is not satisfied. The factor matrix approach in this regard is superior because it can be used for any number of assets. However, the factor model is biased and inconsistent. (LOS 2.g)
2. The manager could have avoided these issues by using shrinkage estimation of the weighted averages of the sample and factor-based VCV matrices. (LOS 2.g)

Module Quiz 2.8

1. The downward sloping yield curve indicates that the economy is likely to contract in the future. In recessions, bonds outperform stocks because inflation and interest rates decrease and economic growth is slow. Assuming the accuracy of the yield curve forecast and that interest rates will fall further, the portfolio manager should consider reallocating from stocks into bonds. (LOS 2.h)
2. The manager should invest in bonds. In periods of declining prices or deflation, bonds perform well because there is no inflation and interest rates are declining. Stocks usually perform poorly during deflationary periods because economic growth is slowing. Real estate also performs poorly during deflationary times, particularly when the investment is financed with debt. (LOS 2.h)
3. The manager should purchase the bonds of Country C. Many emerging market bonds are denominated in a hard currency, so less risky countries have greater foreign currency reserves. Low levels of leverage are also preferred. One measure of leverage is the debt-to-GDP ratio. (LOS 2.h)

TOPIC QUIZ: CAPITAL MARKET EXPECTATIONS

You have now finished the Capital Market Expectations topic section. On your Schweser online dashboard, you can find a Topic Quiz that will provide immediate feedback on how effective your study of this material has been. The test is best taken timed; allow three minutes per question. Topic Quizzes are more exam-like than typical QBank questions or module quiz questions. A score less than 70% suggests that additional review of the topic is needed.

READING 3

OVERVIEW OF ASSET ALLOCATION

EXAM FOCUS

Strategic asset allocation is often considered the most important decision in the portfolio management process. This reading provides a big picture overview of asset allocation and its relationship to the investor's objectives and constraints. It discusses issues related to an investor's overall financial situation and use of an economic balance sheet. It also provides an overview of three major asset allocation approaches (asset-only, liability-relative, and goals-based), passive versus active approaches to implementing the asset allocation, and key issues to consider when rebalancing the asset allocation.

MODULE 3.1: INVESTMENT GOVERNANCE



Video covering this content is available online.

LOS 3.a: Describe elements of effective investment governance and investment governance considerations in asset allocation.

Investment governance ensures that appropriate individuals or groups make informed investment decisions and conduct oversight activities on behalf of investors. The objective of effective governance is to match the investor's objectives with their constraints while ensuring that investment decisions comply with relevant laws and regulations. Investment governance also seeks to improve investment performance by aligning asset allocation with implementation.

Effective investment governance models:

1. Establish long-term and short-term investment objectives.
2. Allocate rights and responsibilities within the governance structure.
3. Specify processes for creating an investment policy statement (IPS).
4. Specify processes for creating a strategic asset allocation.
5. Apply a reporting framework to monitor the investment program's stated goals and objectives.
6. Periodically perform a governance audit.

Investment Objectives

Long-term and short-term objectives articulate what the investor would like to achieve. Some examples of investment objectives are as follows:

- The objective for a pension fund is for plan assets to meet current and ongoing plan liabilities.
- The objective for an endowment is to achieve a rate of return that exceeds the return required to fund current and ongoing distributions.
- The objective for an individual investor is to have sufficient assets for retirement while adhering to constraints and risk preferences.

At the core of the investment objective statement is the return requirement. Additional information that provides context to this required return includes the investor's willingness and ability to tolerate risk, the obligations that require funding, and how cash flows transfer into and out of the fund. The overall goal of the investment objective is to discover the optimal risk/return combination that accounts for the investor's constraints and risk tolerance.

Effective investment governance should also evaluate the liquidity aspects of investments. An allocation that has a relatively high number of illiquid assets will make it difficult to fund obligations during periods of market stress. In addition to liquidity risk, risks to consider include volatility risk and the risk of selling at the worst possible time. Investors should understand that asset allocations that provide high expected returns with high risk will lead to greater price swings. Overall, investors making asset allocation decisions must consider how risk sensitivities influence their required return.

Rights and Responsibilities

Investment governance assists with allocating the rights and responsibilities of the investment program. This allocation will vary depending on the investment program size; the availability of internal staff members; and the knowledge, skills, and abilities of internal staff. Effective governance aims to delegate investment decision-making to the best-qualified individuals. These individuals should have the knowledge and experience to make informed investment decisions. They should also have the capacity to manage the investment program responsibilities and be able to execute the investment program in a timely fashion.

Resource availability will impact the allocation of rights and responsibilities as well as investment program complexity. For example, smaller investment programs will likely have less complex investment options due to smaller asset sizes and fewer internal staff for managing those assets. On the other hand, large investment programs may pursue more complex strategies as long as a robust internal control process exists and the internal staff has appropriate knowledge and experience. However, large investment programs may run into governance issues due to capacity constraints where too many managers are involved in the investment decision-making process.

Investment Policy Statement

An effective investment program begins with a well-developed investment policy statement (IPS). The IPS serves as a roadmap for portfolio management and

provides confidence to stakeholders that the investment program will be managed with due diligence and care.

Strategic Asset Allocation

The investment committee, which is the highest level of the governance structure, will typically approve the strategic asset allocation decision. A proposed asset allocation will be developed after (1) the IPS is constructed, (2) investment results are simulated over the appropriate time horizon(s), and (3) the risk and return attributes of all possible asset allocation strategies are considered. In addition to approving the asset allocation, good governance should also specify rebalancing decisions and responsibilities.

Reporting Framework

A reporting framework allows stakeholders to evaluate performance, investment guideline compliance, and the investment program's progress toward achieving its stated goals and objectives. The framework should outline the current status of the program, where it is in relation to its goals and objectives, and how management decisions have added or subtracted value. Proper benchmarking is important for evaluating the performance of investment managers and staff. Also, management reporting is needed for determining which sections of the portfolio are ahead or behind schedule. In addition, governance reporting should be conducted regularly to address investment program strengths and weaknesses.

Governance Audit

An independent third party should audit the effectiveness of the governance structure, policies, and procedures. The auditor examines governing documents, determines the organization's capacity to effectively execute decisions based on those documents, and reviews portfolio efficiency given any governance constraints. Effective investment governance aims to minimize *decision-reversal risk*, which is the risk of reversing investment decisions at the worst possible time (i.e., creating the maximum loss). This action helps the investment program survive unexpected periods of market stress. Effective investment governance also aims to provide durability by evaluating the turnover of the investment program staff and the investment committee as well as any overreliance on one staff member. New investment committee and staff members should be properly trained on investment documentation, policies, procedures, and decision-making skills to ensure the continued success of the investment program.

MODULE 3.2: ECONOMIC BALANCE SHEET



Video covering this content is available online.

LOS 3.b: Formulate an economic balance sheet for a client and interpret its implications for asset allocation.

The traditional accounting balance sheet encompasses an organization's assets, liabilities, and owner's equity. It is used by accountants to illustrate the financial

position of an organization. In contrast, an **economic balance sheet** contains an organization's financial assets and liabilities, as well as any nonfinancial assets and liabilities that are applicable to the asset allocation decision. These nonfinancial assets and liabilities are referred to as **extended portfolio assets and liabilities** because they are not included on traditional balance sheets.

Investors making appropriate asset allocation decisions should recognize assets and liabilities in both the financial portfolio and the extended portfolio. Extended portfolio assets may include the present value of expected earnings (i.e., human capital) and the present value of pension income (for individual investors) as well as the present value of expected intellectual property royalties and underground mineral resources (for institutional investors). Extended portfolio liabilities may include the present value of expected consumption (for individual investors) and the present value of expected foundation payouts (for institutional investors). An example of an economic balance sheet for an institutional investor can be seen in Figure 3.1.

Figure 3.1: Economic Balance Sheet

Assets		Liabilities and Net Worth	
<i>Financial Assets</i>		<i>Financial Liabilities</i>	
Domestic equity	400	Short-term borrowing	100
Real estate	250	Mortgage obligations	200
<i>Extended Assets</i>		<i>Extended Liabilities</i>	
PV of expected royalties	150	PV of expected payouts	300
		<i>Economic Net Worth</i>	
		Economic assets – Economic liabilities	200
Total	800	Total	800

A practical application of an investment that includes human capital is a life-cycle balanced fund (i.e., target retirement fund). These funds consider the changing levels of human capital and financial capital for an individual investor over time. When an individual enters the workforce, human capital will be much greater than financial capital. However, as the individual ages, financial capital will begin to outweigh human capital because the present value of expected future earnings will gradually decline. At retirement, an individual's total wealth will be made up of financial capital.

Life-cycle balanced funds adjust asset allocations for individual investors over time by taking into account both financial assets and extended portfolio assets. For example, at age 25, a target-date fund may be invested in 85% equity and 15% bonds. This considers the fact that human capital has significant bond-like characteristics. As the investor ages, the equity/bond mix will increase its allocation to bonds as human capital decreases. At retirement (e.g., age 65), the target-date fund may be invested in an asset mix that is closer to 50% equity and 50% bonds.



MODULE 3.3: APPROACHES TO ASSET ALLOCATION

Video covering this content is available online.

LOS 3.c: Compare the investment objectives of asset-only, liability-relative, and goals-based asset allocation approaches.

There are three types of asset allocation approaches: (1) asset-only, (2) liability-relative, and (3) goals-based. In this section, we will discuss the investment objectives of each approach. These asset allocation approaches attempt to match investors' goals with their optimal level of risk.

Asset-only approaches make asset allocation decisions based solely on the investor's assets. An example of an asset-only approach is *mean-variance optimization* (MVO), which incorporates the expected returns, volatility, and correlations of asset classes. The investment objective for this approach is to maximize the expected return per unit of risk (e.g., maximize the Sharpe ratio). The chosen investments should consider investor constraints (stated in the IPS) as well as investor risk tolerance.

Liability-relative approaches involve asset allocation decisions based on funding liabilities, with the objective of paying liabilities when they come due. An example of a liability-relative approach is *surplus optimization*, which is based on principles from mean-variance asset allocation. The surplus is computed as the investor assets value minus the present value of investor liabilities. Modeling liabilities may be achieved by shorting an amount of bonds that matches the duration and present value of liabilities. Liabilities may also be modeled by creating a portfolio designed to hedge the liabilities. Asset allocation focused on funding liabilities is also known as *liability-driven investing* (LDI).

Goals-based approaches are geared toward asset allocations for subportfolios, which help individuals or families achieve lifestyle and aspirational financial objectives. For example, goals could involve maintaining a current lifestyle or donating money to a university at some point in the future. In order to achieve the stated goals, it is necessary to specify the type of cash flows needed (e.g., even, uneven, or bullet payment), the time horizon(s), and the level of risk tolerance in terms of the probability of attaining a certain goal. Each sub-portfolio will have a unique asset allocation designed to meet the stated goals. Summing these asset allocations will produce the investor's overall portfolio strategic asset allocation. Asset allocation focused on investor's goals is also known as *goals-based investing* (GBI).

Both liability-relative and goals-based asset allocation approaches are based on meeting liabilities. The main difference is that liability-relative approaches focus on the liabilities of institutional investors while goals-based approaches focus on the liabilities of individual investors. Institutional investors have legal obligations or debts, whereas individual investors wish to meet specific lifestyle goals. This suggests that penalties for not meeting liabilities are much higher for liability-relative approaches. In addition, the type and number of obligations will differ between approaches. Institutional investor obligations are constant and numerous

(e.g., life insurance and pension benefit payments are the future liabilities of insurance companies and defined benefit pension plans), while individual investor goals are much less predictable. This suggests that institutional liabilities can be more confidently forecasted since the average of a large number of obligations is more certain than the uncertain time horizon needs of one individual investor.

Relevant Risk Concepts

LOS 3.d: Contrast concepts of risk relevant to asset-only, liability-relative, and goals-based asset allocation approaches.

Risk concepts associated with asset-only approaches focus on asset class risk as well as constructing effective asset class combinations. The relevant risk measure for MVO, the most popular asset-only approach, is the standard deviation of portfolio returns, which incorporates asset class volatilities and asset class return correlations. Other risk sensitivities, such as relative risk and downside risk, can also be measured with a mean-variance framework. For example, the risk relative to a benchmark can be modeled with tracking error, and downside risk can be modeled with value at risk (VaR), semivariance, or maximum drawdown.

Monte Carlo simulation is a statistical modeling tool often used to complement MVO. For example, a manager could begin by selecting several optimal portfolios using MVO that have acceptable risk and return for the client and then use Monte Carlo simulation to generate multiple simulated paths, which display how these portfolios would perform over time. This action would provide useful information on downside risk when portfolios encounter a market stress scenario. These results can then be used to refine asset allocation decisions.

Risk concepts associated with liability-relative approaches focus on not having enough assets to pay liabilities when they come due. The volatility of contributions used for funding liabilities is also a risk. The standard deviation of the surplus may be used as the relevant risk measure. In general, the differences between asset and liability characteristics (e.g., size, sensitivity to interest rate changes) are the main drivers of risk for liability-relative asset allocation approaches.

Risk concepts associated with goals-based approaches focus on the risk of not being able to achieve the stated financial goals. If an investor has multiple goals, then the risks will encompass multiple future time periods. Thus, portfolio risk under a goals-based approach is the weighted sum of the risk that is attached to each goal.



MODULE QUIZ 3.1, 3.2, 3.3

1. Which of the following investment objectives would *most likely* be associated with a defined benefit pension fund?
 - A. Plan assets should meet current and future plan liabilities.
 - B. Assets should provide for retirement subject to each investor's constraints and risk tolerance.
 - C. The rate of return should meet the current distribution rate plus future inflation.

2. Which of the following investments would *most likely* be part of the extended portfolio of the assets and liabilities sections on an economic balance sheet?
 - A. Human capital.
 - B. Financial assets.
 - C. Financial liabilities.
3. Which of the following asset allocation approaches is focused on achieving lifestyle and aspirational financial objectives?
 - A. Asset-only approach.
 - B. Goals-based approach.
 - C. Liability-relative approach.
4. The asset allocation approach that is concerned with the risk of not having enough assets to pay liabilities when they come due is known as:
 - A. asset-only.
 - B. goals-based.
 - C. liability-relative.

MODULE 3.4: ALLOCATION BY ASSET CLASS OR RISK FACTOR



Video covering this content is available online.

LOS 3.e: Explain how asset classes are used to represent exposures to systematic risk and discuss criteria for asset class specification.

An asset class is a group of assets that have similar investment characteristics. Each asset class has its own quantifiable systematic risk, and strategic asset allocation is a conscious effort to gain the desired exposure to systematic risk via specific weights to individual asset classes. Exposure to specific asset classes in specific proportions enables portfolio managers to effectively monitor and control their systematic risk exposure. In other words, strategic asset allocation reflects the investor's desired systematic risk exposure.

In a generic sense, there are three categories of “super asset classes”: (1) capital assets, which provide a continuous source of value (e.g., dividends), (2) consumable or transformable assets, which can be consumed or transformed into a source of value (e.g., commodities), and (3) store-of-value assets, which provide value when exchanged or sold (e.g., currencies, art).

For the purposes of asset allocation, it is necessary to define asset classes. With this information, investors and managers can better distinguish among asset classes when developing an investment strategy. For example, combining emerging market equities and domestic equities into a single asset class labeled *equities* would be appropriate only from a general description standpoint; their risk and return characteristics are obviously different. The following criteria can be used to specify asset classes:

- *Assets in an asset class should have similar attributes from both a descriptive and statistical perspective.*
- *Assets cannot be classified into more than one asset class.* If it can be legitimately argued that assets can be placed in more than one class, the descriptions of the classes are too vague.

- *Asset classes should not be highly correlated in order to provide desired diversification.* A high correlation between classes would indicate that the classes are related from a risk and return standpoint. This would defeat the purpose of holding separate classes in an allocation.
- *Asset classes should cover all possible investable assets.* This factor not only increases the set of investable assets, but also pushes up the efficient frontier (i.e., increases expected return at all levels of risk).
- *Asset classes should contain a sufficiently large percentage of liquid assets.* If liquidity and transaction costs are significant, the asset class may not be ideal for investment because it lacks sufficient liquidity.

Some well-accepted asset classes include domestic equity, domestic fixed income, global equity, global fixed income, cash and equivalents, and alternative investments, which may be further divided into classes such as real estate, private equity, et cetera.

Too much granularity (number of subdivisions of classes used) in the asset allocation can make it difficult to construct an optimal portfolio based on an investor's required level of return and risk. Within each asset class, sub-asset classes can be created that are less distinct than their corresponding broad asset classes. For example, Figure 3.2 shows how the asset class of global equity can be broken down into U.S. and non-U.S. equity securities. The sub-asset class of U.S. equities can be further segmented into large-cap and small-cap equities.

Figure 3.2: Asset Classes and Sub-Asset Classes

Asset Classes	Sub-Asset Classes	
Global equity	U.S. equities	Large-cap equities
		Small-cap equities
	Non-U.S. equities	Developed countries
		Emerging countries
Global fixed income	U.S. debt	Investment-grade debt
		High-yield debt
	Non-U.S. debt	Developed countries
		Emerging countries

Strategic asset allocation should focus primarily on the asset class divisions that have distinctly different characteristics and will provide diversification (i.e., global equity versus fixed income). As you move down in granularity (level of subdivision) the differential between classes will shrink (i.e., U.S. and non-U.S. equity will be less distinctly different from each other than global equity versus global fixed income). However, when progressing from strategic asset allocation to policy implementation and tactical asset allocation, decisions may focus more on the sub-asset classes.

Common Risk Factors

LOS 3.f: Explain the use of risk factors in asset allocation and their relation to traditional asset class-based approaches.

Asset classes have traditionally been used as units of analysis when making asset allocation decisions. This process is known as *asset-based asset allocation*. For example, MVO incorporates expected return, volatility, and correlation estimates from the selected asset classes. However, using asset classes in this fashion may be problematic due to overlapping risk factors among asset classes.

An investor selects asset classes based on their desired exposure to common risk factors. Examples of risk factors include volatility, liquidity, inflation, interest rates, duration, foreign exchange, and default risk. As mentioned, risk factor exposures may overlap across multiple asset classes. For example, the asset classes of domestic equity and domestic fixed income will both share exposures to foreign exchange (in the sense that changes in value of the domestic currency can affect profitability of issuers and return on investments in their debt and equity), liquidity, and volatility risk factors. Examining these overlapping risk factors can help investors identify the correlations among asset classes.

Due to overlapping risk factors, it may be insightful to focus on risk factors rather than traditional asset classes as units of analysis. This is accomplished by identifying the risk factors as well as the desired exposure to each factor. Multifactor models can then be used for asset allocation by creating factor portfolios, which isolate systematic risk exposures (i.e., nondiversifiable risks). This process is known as *factor-based asset allocation*.

This does not mean risk factor analysis is inherently more useful. It has its own limitations. For example investors may not be able to directly invest in all risk factors. But risk factor analysis may offer additional insight, and risk factors often correspond to expected return premiums. Some risk factors may be investable with spread positions, which take long and short positions in assets, or by using derivatives. For example, to isolate inflation risk, an investor would go long Treasuries (which reflect compensation for consensus-expected inflation) and short inflation-linked bonds (which will adjust and compensate for actual future inflation); or an investor would invest in volatility index (VIX) futures with payoffs based on actual change in volatility.

Strategic Asset Allocation

LOS 3.g: Recommend and justify an asset allocation based on an investor's objectives and constraints.

Strategic asset allocation combines capital market expectations (expected return, volatility, and correlation) with an investor's risk, return, and investment constraints (from the IPS). Strategic asset allocation is long term in nature, and the weights are called *targets* and the portfolio represented by the strategic asset allocation is a *policy portfolio*, *target portfolio*, or *benchmark*.

Most quantitative approaches to asset allocation are based on utility theory. This framework uses a utility function that incorporates investor risk aversion. Expected utility for a certain asset allocation is determined with a distribution of ending wealth values, which is based on asset class weights, asset class returns, and

beginning wealth values. The maximum level of utility, subject to asset class constraints, will represent the investor's optimal asset association given the investment horizon.

Selecting and justifying a strategic asset allocation based on investor objectives and constraints is outlined in the following steps:

1. *Determine investor objectives.* Relevant questions include the following: How will the investor use these assets? What would the investor like to achieve? What are the investor liabilities and goals? How should the objectives be measured?
2. *Determine investor tolerance for risk.* Relevant questions include the following: What are the investor's sensitivities to risk? How should risk be measured in terms of asset allocation?
3. *Determine investor time horizon(s).* Relevant questions include the following: What investment horizon should be used to evaluate investor objectives? What investment horizon should be used to evaluate investor risk tolerance?
4. *Determine investor constraints.* Relevant questions include the following: What is the investor's tax situation? Are there any social, environmental, or governance considerations? Are legal, regulatory, and political issues a consideration? Does the IPS indicate any additional constraints?
5. *Select the asset allocation approach.* This is the asset allocation that is most ideal for the investor's situation (e.g., asset-only, liability-relative, goals-based).
6. *Specify the asset classes.* Once the asset classes are appropriately specified, capital market expectations can be established.
7. *Develop potential asset allocations.* With optimization procedures, a number of asset allocation choices can be constructed for investor consideration.
8. *Simulate results of potential asset allocations.* The potential asset allocations should be tested to see if the results align with the investor's objectives and risk tolerance for the chosen investment horizon.
9. *Repeat Step 7 until the optimal asset allocation is discovered.*

Once the strategic allocation has been implemented, it should be monitored regularly as specified in the IPS. The monitoring process should contain a feedback loop so that changes in long-term market factors can be incorporated back into the model. An assessment can then be made to determine whether adjustments to the strategic allocation are justified. If the market changes are only short term in nature, the manager should consider implementing tactical allocation measures, as will be discussed elsewhere.



MODULE QUIZ 3.4

1. Which of the following statements identifies one criterion for specifying an asset class when making asset allocation decisions?
 - A. Assets may be classified into more than one asset class.
 - B. Asset classes cover all possible investable assets.
 - C. Asset classes should be highly correlated in order to provide desired diversification.
2. Duration and convexity would *most likely* be risk factors for which type of asset class?

- A. Domestic equities.
- B. Domestic real estate.
- C. Domestic fixed income.

MODULE 3.5: EXAMPLE: STRATEGIC ASSET ALLOCATION



Video covering this content is available online.



PROFESSOR'S NOTE

The following example provides a general overview of constructing a strategic asset allocation.

EXAMPLE: Strategic asset allocation

Nathan Tillman is a 50-year-old entrepreneur who plans to retire in five years. He is considering purchasing an annuity for retirement. He has a \$5 million portfolio with \$1 million in real estate and \$700,000 in mortgage debt. He would like to eliminate all mortgage debt before retirement. His son, David, is 18 years old and starting college this year with eventual plans for medical school. Tillman estimates he will contribute \$500,000 to his son's education. Tillman is generally conservative with his investments, does not like portfolio volatility, and does not have any social or environmental investment constraints. For Asset Allocation A and then for Asset Allocation B:

- **State** whether it is most consistent with (1) an asset-only, (2) a liability-relative, or (3) a goals-based approach to asset allocation.
- **Give one** reason based on Tillman's situation that the approach is appropriate for Tillman.

Do not draw any conclusion as to the optimal overall approach to allocation for Tillman.

Asset Allocation	Cash	Global Equities	Global Fixed Income	Diversifying Strategies
A	45%	15%	35%	5%
B	5%	50%	20%	25%

Answer:

Asset Allocation A is consistent with a goal-based approach because:

- It has more than sufficient cash for liquidity needs of \$1.2 million to pay the mortgage and education expense. The cash can also be used for the possible annuity purchase.
- The high allocation to cash would reduce portfolio volatility.
- It fits his conservative investment views.

Asset Allocation B is consistent with an asset-only approach because:

- It emphasizes higher growth equity.
- It provides diversification with alternative investments and some fixed income.

Note that you were directed not to draw any final conclusion. This was an initial step that illustrates the need to develop a complete IPS and consider additional

asset allocations that may best meet those objectives.

MODULE 3.6: OTHER APPROACHES AND ISSUES



Video covering this content is available online.

LOS 3.h: Describe the use of the global market portfolio as a baseline portfolio in asset allocation.

Financial theory proposes that the first asset allocation to consider should be the **global market portfolio**. This portfolio contains all available risky assets (i.e., global equity, global fixed income, real estate, etc.) in proportion to their total market values. It is also the portfolio that minimizes diversifiable risk since it is the most diversified portfolio possible. The market portfolio is found on the efficient frontier by drawing a line from the risk-free asset that is tangent to the efficient frontier (known as the capital market line). The point of tangency is the location of the global market portfolio.

The asset class weights within the global market portfolio serve as a good starting point for asset allocation. The portfolio's weights can then be adjusted to meet specific investor objectives, constraints, and desires (e.g., a home-country or small-cap basis).

Note that it's challenging to invest in some asset classes within the global market portfolio. For example, investments in residential real estate or private equity may not be practical for individual investors. For this reason, investors often use a proxy to represent the global market portfolio, such as a portfolio of exchange-traded funds (ETFs).



PROFESSOR'S NOTE

Recall that nondiversifiable risk can also be called market, priced, or systematic risk. Diversifiable risk can also be called non-market, non-priced, company-specific, or unsystematic risk. Remember that you should expect compensation in the form of higher expected return for taking nondiversifiable risk but not for taking diversifiable risk.

Strategic Implementation Choices

LOS 3.i: Discuss strategic implementation choices in asset allocation, including passive/active choices and vehicles for implementing passive and active mandates.

Once the strategic asset allocation has been constructed, implementation choices must be made regarding passive/active management for both asset class weights and allocations within asset classes. The first aspect of passive/active choices is to determine if the investor should deviate from the strategic asset allocation by adjusting the asset mix. The second aspect is to decide how investors should make

allocations within selected asset classes. Managing and monitoring the portfolio in terms of a client's changing needs is an important element of portfolio management.

Passive/Active Choices for Asset Class Weights

Tactical asset allocation (TAA) is an active management strategy that deviates from the strategic asset allocation (SAA) to take advantage of perceived *short-term* opportunities in the market. TAA introduces additional risk, seeking incremental return, often called alpha. These deviations from the SAA weightings by asset class should be restricted by risk budgets or rebalancing ranges that control the amount of deviation. The deviations may be based on forecasted asset class valuation, business cycle state, or stock price momentum. A multiperiod view of the investment horizon is sometimes referred to as **dynamic asset allocation (DAA)**. DAA recognizes that asset (and liability) performance in one period affects the required rate of return and acceptable level of risk for subsequent periods. Changes to the SAA may be limited to simply adjusting the mix between stocks, bonds, and cash. Conversely, global TAA may involve a broader and more complex multiasset approach.

With tactical asset allocation, there is a tradeoff between potential outperformance and tracking error. A key limitation of this approach is the additional trading and monitoring costs as well as possible capital gains taxes. Thus, the decision to implement a tactical asset allocation should be evaluated under a cost-benefit approach.

Passive and Active Choices Within Asset Classes

Passive and active management choices can also be made regarding the allocations within asset classes. Under **passive management**, investor insights or expectations do not impact the composition of the portfolio. Examples of a passive approach include indexing or holding bonds to maturity. With indexing, the portfolio may add or drop positions based on the index holdings, but it would not react to the changing expectations of investors regarding valuations. In contrast, under **active management**, the portfolio composition changes when investor insights or expectations change. The goal of active management is to earn risk-adjusted returns that exceed an associated passive benchmark.

To better understand the degree of passive/active management in a portfolio, we can view decisions along a spectrum from most passive to most active. The most passive approach would include buying and holding a self-rebalancing, broad index of risky assets, such as the global market portfolio. Tilting the allocation toward a certain investment style index (e.g., growth equity index) is slightly more active given that it involves an active decision, but it still uses the passive implementation of indexing. The next step toward a more active approach would involve taking a growth investment approach while using security selection to enhance returns. The most active approach would include unconstrained mandates where the portfolio is not managed with regard to traditional benchmarks.

In general, indexing is considered a low-cost means of investing. However, some transaction costs are involved when the portfolio must adjust positions based on the changing composition of the index. Furthermore, if the index is tracked with a different weighting approach, such as equally weighted rather than market-cap

weighted, additional transaction costs will apply. Portfolios that follow a fixed-income index will also incur transaction costs as bonds reach maturity, are called, or default. As a portfolio moves from passive to active, tracking error and expected active return relative to a benchmark will increase. These measures quantify the degree of active management within a portfolio.

The decision of where to invest along the active/passive spectrum depends on the following factors:

- Availability of appropriate investments (e.g., a relevant index).
- Active management scalability in terms of value added from each active decision.
- Investor constraints, such as social and environmental concerns, when using a passive approach.
- An investor belief in efficient markets, which would discourage the use of active management.
- The cost-benefit tradeoff where additional transaction costs are needed for achieving excess returns.
- The tax status of investors, which differs between taxable and tax-exempt investors.

Risk Budgeting

Asset allocation can also be conducted with a risk perspective. The types of risk to take, as well as the amount of risk to take, is addressed with **risk budgeting**.

Measuring risk may differ depending on the risk focus, such as volatility of returns or tail risk. In these cases, risk would be quantified with the standard deviation of returns and value at risk (VaR), respectively. Risk budgets can be established in either relative or absolute terms and stated in either money or percentage terms (e.g., 10% return volatility). These risk budgets specify how risk should be distributed among portfolio assets without regard to asset expected returns.

In the context of making passive/active asset allocation choices, active risk budgeting determines how much additional risk the investor is willing to take relative to the benchmark. The objective of this approach is to outperform the benchmark while sticking to the investor's risk budget. Regarding passive/active choices for the asset class mix, active risk is determined relative to the strategic asset allocation benchmark. Regarding passive/active choices for allocation within asset classes, active risk is determined relative to the asset class benchmark.

Rebalancing

LOS 3.j: Discuss strategic considerations in rebalancing asset allocations.

Strategic asset allocation responds to the interaction of the investor's long-term strategic (policy) needs and long-run capital market expectations. The investor's goals are expressed in terms of IPS objectives and constraints. The allocation itself is typically specified in a range of percentages (e.g., a strategic allocation for domestic equity of 30% to 40%), and if the actual percentage wanders outside that range, the

portfolio needs to be rebalanced. Rebalancing can be triggered by normal asset price changes, which cause the asset mix to fluctuate from its target weights.

The primary benefit of rebalancing is maintaining the investor's desired exposure to systematic risk factors. If the portfolio is allowed to simply drift, the riskier assets in the portfolio tend to take over. For example, as the value of the equities in a portfolio increases, the equities become an ever larger percentage of the portfolio and the risk of the portfolio increases accordingly. Only by rebalancing the portfolio (e.g., selling equities and buying debt) will the portfolio return to its original risk and return characteristics as specified in the investor's IPS.

Rebalancing also provides discipline. Often the investor will see significant gains in the equity portion of the portfolio and want to "let it ride." Successful performance may lead the client to react to temporary market conditions rather than follow a long-term, disciplined approach. But "letting it ride" can also lead to the failure to realize the gains from temporarily overvalued securities before they fall back to their true values. This could be considered a potential cost of not rebalancing.

Of course, when equities become too large of a portion within the portfolio and we sell them to rebalance, there is an associated tax liability. In addition, the investor will face transaction costs. The costs of rebalancing can be affected by the conditions under which the trade is made (i.e., whether the trade requires liquidity from or provides liquidity to the market). If the manager is selling when other managers are selling, the trade requires liquidity and the associated transaction cost (bid-ask spread) can be substantial. If the trade provides liquidity, on the other hand (e.g., selling when others are buying), the costs may be minimal.

Rebalancing Approaches

Rebalancing an allocation to its precise target weight requires more or less constant trading. With constant analysis and trading come the associated transaction costs and the inability to time trades. Rather than set strict target allocations, managers will set allowable ranges that they consider optimal for the asset classes. In order to provide discipline to portfolio rebalancing, managers can adopt either calendar-based rebalancing or range-based balancing.

Calendar rebalancing. As its name implies, calendar rebalancing is rebalancing the portfolio to its strategic allocation on a predetermined, regular basis (e.g., monthly or quarterly). Generally, the frequency of rebalancing depends on the volatility of the portfolio, but sometimes rebalancing is scheduled to coincide with review dates.

The primary benefit to calendar rebalancing is that it provides discipline without the requirement for constant monitoring. The drawback is that the portfolio could stray considerably between rebalancing dates and return to its strategic allocation ranges on the rebalancing date. In other words, rebalancing is related to the passage of time rather than the value of the portfolio.

Percentage-range rebalancing. With this approach, rebalancing is triggered by changes in value rather than calendar dates. The manager sets what are called tolerance bands or corridors that are considered optimal for each asset class. For example, a corridor of $50\% \pm 5\%$ would indicate that the related asset class must stay within a band of 45% to 55%. If the asset class wanders outside that corridor,

which would no doubt mean other classes have violated their corridors also, the portfolio is rebalanced.

By not waiting for specified rebalancing dates, range-based rebalancing provides the benefit of minimizing the degree to which asset classes can violate their allocation corridors. Cost is increased by the time and expense of constantly monitoring the portfolio (as compared to only checking valuations on the specified calendar dates) and by potentially more frequent trading.

When applying range-based rebalancing, the following four questions need to be addressed:

- Who is ultimately responsible for rebalancing the portfolio?
- How frequently should the portfolio be monitored for rebalancing decisions?
- What is the size of the rebalancing corridors?
- Should rebalancing to target weights be fully or only partially corrected?

Strategic Considerations

The optimal width of the corridor for an asset class will depend on the following:

- **Transaction costs.** Obviously, the more expensive it is to trade, the less frequently you should trade. If an asset is particularly illiquid, for example, trading can be quite expensive. In that case, the corridor for the class should be wide. In general, the more illiquid the asset, the wider the corridor.
- **Risk tolerance.** More (less) risk-averse investors will have tighter (wider) rebalancing corridors.
- **Correlations.** The more highly correlated the assets (allocations) in a portfolio, the less frequently the portfolio will require balancing. If all assets tend to move together, their values will tend to stay within acceptable ranges. For example, if stocks and bonds both increase 20% in value (assuming only stocks and bonds in the portfolio), their weights in the portfolio will probably stay within acceptable limits. However, if stocks increase 20% while bonds decrease 20%, they will probably both violate their corridors.
- **Momentum.** If investors believe that current trends will continue, an argument can be made for using wider rebalancing corridors. Conversely, if investors anticipate mean reversion, tighter rebalancing corridors should be applied.
- **Liquidity.** Illiquid investments, such as private equity and real estate, are typically associated with larger trading costs. These liquidity costs encourage the use of wider rebalancing corridors.
- **Derivatives.** Rather than selling underlying assets, a derivatives overlay strategy can be used to synthetically rebalance a portfolio. This approach results in lower transaction costs, lower taxes, and can be executed quicker and easier compared to rebalancing with only the underlying stock and bonds. The tradeoff is that derivatives require additional risk management when used as a rebalancing tool.
- **Taxes.** When making rebalancing decisions, taxes must be considered since realized capital gains and losses will impact investor taxes. Therefore, taxable portfolios will typically have wider rebalancing corridors than tax-exempt portfolios. The corridors may also be asymmetric due to tax savings (i.e., loss

harvesting). This suggests that the range may be less below a certain target weight than above (e.g., the tolerance band may go from 48% to 55% for a 50% target weight).

Asset class **volatility** also has an impact on optimal corridor width. In the simplest situations, higher volatility *most likely* calls for narrower corridors in order to control risk. But the impact of volatility can be more complex than that. **Higher volatility** (in the absence of high positive correlation between classes) will lead asset class weights to shift more quickly.

- But more frequent rebalancing increases transaction costs. This argues for wider corridors to control transaction costs, particularly when those costs are substantial.
- This argues for narrower corridors to control risk exposure. (Consider this the most likely conclusion.)

Ultimately the choice of corridor width depends on a trade-off between risk control, transaction costs, and correlations between classes. In complex situations, a quantified cost-benefit analysis will be required.



MODULE QUIZ 3.5, 3.6

1. Jack Manning, CFA, and Tess Brown, CFA, have just joined a financial planning firm. They will work as a team assessing and managing the portfolios of individual clients. Manning will specialize in forming long-term capital market expectations. Brown focuses on relative value models to assess shorter-term over- and undervaluation. Based on this information, we would define the focus of:
A. both Manning and Brown as tactical asset allocation.
B. both Manning and Brown as strategic asset allocation.
C. Manning as strategic asset allocation and Brown as tactical asset allocation.
2. Which of the following statements is *most correct* regarding the global market portfolio as the baseline portfolio in asset allocation?
A. The market portfolio contains most investable risky assets.
B. The market portfolio minimizes total risk since it is the most diversified portfolio.
C. Investors can use a proxy to represent the market portfolio, such as a portfolio of exchange-traded funds (ETFs).
3. Deviation from strategic asset allocation due to short-term capital market expectations is *most correctly* called:
A. active management.
B. tactical asset allocation (TAA).
C. alpha management.
4. Which of the following asset allocation rebalancing techniques provides discipline without need for constant monitoring?
A. Range-based balancing.
B. Corridor-based rebalancing.
C. Calendar-based rebalancing.

KEY CONCEPTS

LOS 3.a

Investment governance models should:

- Establish long-term and short-term investment objectives.
- Allocate the rights and responsibilities of all the involved parties.
- Specify processes for creating an investment policy statement (IPS).
- Specify processes for creating a strategic asset allocation.
- Apply a reporting framework to monitor the investment program's stated goals and objectives.
- Include periodic review of the governance policies by an independent third party.

LOS 3.b

An economic balance sheet contains an organization's financial assets and liabilities, as well as any nonfinancial assets and liabilities that are applicable to the asset allocation decision. These nonfinancial assets and liabilities are referred to as extended portfolio assets and liabilities because they are not included on traditional balance sheets. A practical application of an investment that includes human capital (an extended portfolio asset) is a life-cycle balanced fund. These funds consider the changing levels of human capital and financial capital for an individual investor over time.

LOS 3.c

There are three types of asset allocation approaches: (1) asset-only, (2) liability-relative, and (3) goals-based. Asset-only approaches make asset allocation decisions based on the investor's assets. Liability-relative approaches involve asset allocation decisions based on funding liabilities. Goals-based approaches are geared toward asset allocations for subportfolios, which help an individual achieve lifestyle and aspirational financial objectives.

LOS 3.d

Risk concepts associated with asset-only approaches focus on asset class risk as well as constructing effective asset class combinations. The relevant risk measure is the standard deviation of portfolio returns. Risk concepts associated with liability-relative approaches focus on not having enough assets to pay liabilities when they come due. The relevant risk measure is the standard deviation of the surplus. Risk concepts associated with goals-based approaches focus on the risk of not being able to achieve the stated financial goals.

LOS 3.e

Asset classes have been appropriately specified if:

- Assets in an asset class have similar attributes from both a descriptive and statistical perspective.
- Assets cannot be classified into more than one asset class.
- Asset classes are not highly correlated.
- Asset classes cover all possible investable assets.
- Asset classes contain a sufficiently large percentage of liquid assets.

LOS 3.f

Investors select asset classes based on their desired exposure to common risk factors. Examples of risk factors include volatility, liquidity, inflation, interest rates, duration, foreign exchange, and default risk. Risk factor exposures may overlap

across multiple asset classes. Examining these overlapping risk factors can help investors identify the correlations among asset classes.

LOS 3.g

Strategic asset allocation is long term in nature; hence, the weights are called *targets* and the portfolio represented by the strategic asset allocation is called the *policy portfolio*.

Selecting and justifying a strategic asset allocation based on investor objectives and constraints is outlined in the following nine steps:

1. Determine investor objectives.
2. Determine investor tolerance for risk.
3. Determine investor time horizon(s).
4. Determine investor constraints.
5. Select the asset allocation approach.
6. Specify the asset classes.
7. Develop potential asset allocations.
8. Simulate results of potential asset allocations.
9. Repeat Step 7 until the optimal asset allocation is discovered.

LOS 3.h

Investors may consider the global market portfolio as a baseline asset allocation. It will minimize (eliminate) diversifiable risk. Because it's challenging to invest in some asset classes within the market portfolio, investors often use a proxy, such as a portfolio of exchange-traded funds (ETFs).

LOS 3.i

The SAA can be implemented with passive or active management for both asset class weights and allocations within asset classes.

- TAA introduces active decisions to deviate from the SAA in an effort to add value, but it is likely to increase error.
- Active management security selection is based on investor insights or expectations.

Risk budgeting specifies which risks and how much of each risk can be taken. Active risk budgeting specifies risk as allowable deviations from the portfolio's benchmark.

LOS 3.j

Calendar rebalancing is done on a periodic basis, and percentage-range rebalancing is done when a corridor is breached.

Wider optimal corridors are associated with:

- Higher transaction costs (including costs due to tax and illiquidity).
- Increased investor risk tolerance.
- Higher correlations among asset classes.
- Belief in momentum and that trends persist.
- Less volatile asset classes.

Derivatives may allow synthetic rebalancing at a lower cost.

Capital gains taxation suggests setting asymmetric rebalancing corridors (e.g., a 28% to 35% range around a 30% target weight).

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 3.1, 3.2, 3.3

1. **A** The objective for a defined benefit pension fund is for plan assets to meet current and ongoing plan liabilities. Choice B is generally appropriate but phrased more for an individual investor, and Choice C is appropriate for a foundation or endowment fund (and sometimes for individuals). Defined benefit plan inflation issues are already reflected in the actuary provided present value of the liabilities (PVL). (Module 3.1, LOS 3.a)
2. **A** An economic balance sheet contains all of an organization's financial assets and liabilities, as well as any nonfinancial assets and liabilities that are applicable to the asset allocation decision. Extended portfolio assets may include the present value of expected earnings (i.e., human capital). The others are already part of a more traditional balance sheet. They are part of the economic balance sheet but not the extended section. (Module 3.2, LOS 3.b)
3. **B** Goals-based approaches are geared toward asset allocations for subportfolios, which help individuals or families achieve lifestyle and aspirational financial objectives. (Module 3.3, LOS 3.c)
4. **C** Risk concepts associated with liability-relative asset allocation approaches focus on not having enough assets to pay liabilities when they come due. (Module 3.3, LOS 3.c)

Module Quiz 3.4

1. **B** As a group, asset classes cover all possible investable assets. Assets cannot be classified into more than one asset class. Also, asset classes should not be highly correlated. (LOS 3.e)
2. **C** The asset class of domestic fixed income would most likely include default risk, duration, and convexity risk factors in addition to foreign exchange, liquidity, and volatility risk factors. (LOS 3.f)

Module Quiz 3.5, 3.6

1. **C** Manning is using longer-term capital market expectations to form strategic asset allocation, while Brown is looking at shorter-term indicators, which is TAA. (Module 3.6, LOS 3.i)
2. **C** The global market portfolio contains *all* available risky assets in proportion to their total market values. It is also the portfolio that minimizes *diversifiable* risk since it is the most diversified portfolio possible. The total risk (standard deviation) of the market portfolio is not the lowest possible. Over any specific time period the risk-free asset has zero standard deviation. It's challenging to

invest in some asset classes within the global market portfolio. For this reason, investors often use a proxy to represent the global market portfolio, such as a portfolio of ETFs. (Module 3.6, LOS 3.h)

3. **B** Short-term deviations from the strategic asset allocation to take advantage of short-term capital market expectations is called TAA. The motives for TAA may well include active management and adding alpha, but they are less accurate labels for what was described. (Module 3.6, LOS 3.i)
4. **C** The primary benefit to calendar rebalancing is that it provides discipline without the requirement for constant monitoring. Range- or corridor-based rebalancing provides the benefit of minimizing the degree to which asset classes can violate their allocation corridors, but it can be more costly in that it requires continual monitoring of the portfolio. (Module 3.6, LOS 3.j)

READING 4

PRINCIPLES OF ASSET ALLOCATION

EXAM FOCUS

The reading reviews the mean-variance optimization (MVO) approach to strategic asset allocation (SAA) that has been taught at Levels I and II. The focus then shifts to MVO pitfalls and how MVO can be more practically applied to real-world portfolios.

The mathematics behind many of these discussions is beyond the scope of the exam or a typical charterholder. Do not try to learn details that are not covered in the material. If you want to pursue some of these for personal interest after the exam, a Google search is a good starting point.

MODULE 4.1: BASIC MEAN-VARIANCE OPTIMIZATION



Video covering this content is available online.

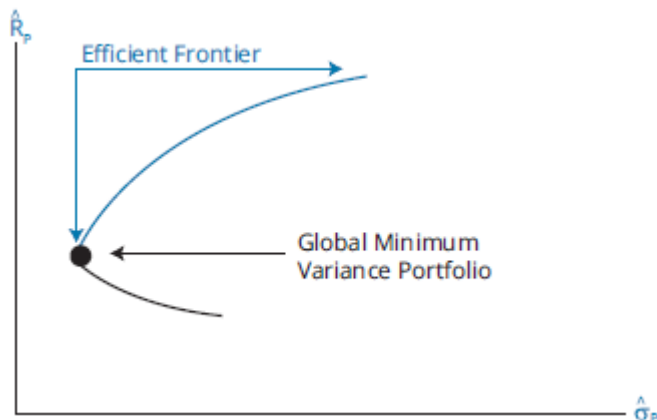
LOS 4.a: Describe and evaluate the use of mean-variance optimization in asset allocation.

Creating a diversified portfolio with allocations to multiple asset classes requires:

- Asset allocation decision: using the investors' objectives and constraints to identify the appropriate portfolio weights for the various asset classes.
- Implementation decisions: identifying the specific assets within each asset class according to the weights specified in the first step.

Mean-variance optimization (MVO) is the most common approach to asset allocation. It assumes investors are risk averse, so they prefer more return for the same level of risk. Given an opportunity set of investable assets, their expected returns and variances, as well as the pairwise correlations between them, MVO identifies the portfolio allocations that maximize return for every level of risk. If the MVO analysis includes all investable risky assets, the result is the familiar "efficient frontier" (at least it should be familiar to the Level III candidate!), as shown in Figure 4.1. The analysis can also be constrained by an investor's objectives and constraints to some subset of assets suitable to that investor.

Figure 4.1: Mean-Variance Efficient Frontier



One approach to finding the optimal point on the efficient frontier for a given investor is to maximize that investor's utility:

$$\text{Utility maximization: } U_m = E(R_m) - 0.005 \times \lambda \times \text{Var}_m$$

U_m = the investor's utility from investing in a portfolio with asset allocation m

$E(R_m)$ = the expected return of the portfolio with asset allocation m (expressed as a %)

λ = the investor's risk aversion coefficient ("lambda")

$\text{Var}_m = \sigma_m^2$ = the variance of the portfolio with asset allocation m (expressed as a %)



PROFESSOR'S NOTE

The investor's utility function as shown assumes the expected return and variance are expressed in percentage terms (e.g., 8% is input as 8.00) so that the appropriate coefficient is 0.005. If the expected return and variance are expressed in decimal terms (e.g., 0.08), you should use the coefficient 0.5.

Lambda captures each individual investor's preference for trading off risk and return. If you look closely at the formula, you'll see that higher expected return for the same level of risk will increase the investor's utility, while a higher risk for the same level of return will decrease the investor's utility. This is consistent with a risk-averse investor, as it imposes a "penalty" for risk. U_m is also referred to as the *certainty-equivalent return*.

Lambda is unique to each individual and is based on the investor's willingness and capacity to take on risk. A risk-neutral investor will have a lambda of 0, although in practice it is typically assumed to be between 1 and 10 with an average level of 4.

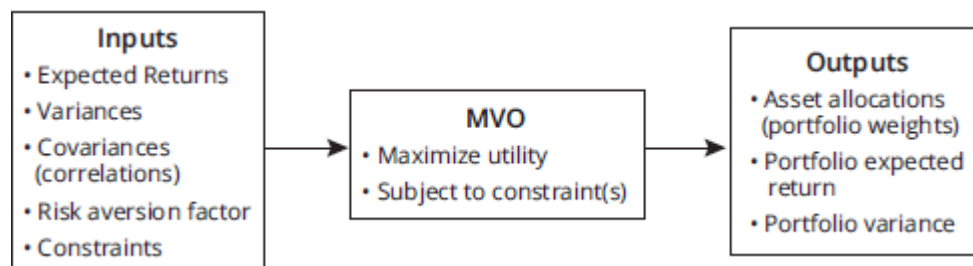
Maximization problems in general usually also have constraints. In other words, the objective function is maximized subject to one or more constraints. These are restrictions on the variables in the objective function. In MVO, the constraints typically involve the portfolio weights, but they can also reflect restrictions on portfolio expected return, variance, or both.

The most common constraint in MVO is called the *budget constraint* or the *unity constraint*, which means the asset weights must add up to 100%. The next most common constraint used in MVO is the *nonnegativity constraint*, which means all weights in the portfolio are positive and between 0% and 100% (there are no short

positions in the SAA). We will discuss other common constraints throughout this topic review.

A graphical depiction of MVO is shown in Figure 4.2.

Figure 4.2: MVO Process



Levels I and II focused on a more academic treatment of MVO. That approach assumed:

- All tradable assets were included in the optimization and efficient frontier.
 - We will no longer assume all assets are used or that the efficient frontier constructed from all assets is necessarily optimal for a given investor.
- That a true risk-free asset exists and the optimal allocation line between the risk-free asset and the efficient frontier identifies an optimal (the market) portfolio that all investors should use (allocating between the tangent portfolio and risk-free asset). That optimal tangent portfolio is the portfolio on the efficient frontier with the highest Sharpe ratio.
 - We will no longer assume a true risk-free asset exists where risk-free means the variance of return is zero and return is uncorrelated with the return of other assets (correlation = 0).

Criticisms of MVO

There are a number of criticisms of MVO that we will address throughout this reading.

1. **GIGO:** The quality of the output from the MVO (portfolio allocations) is highly sensitive to the quality of the inputs (i.e., expected returns, variances, and correlations). In other settings, this is often called the “garbage-in-garbage-out” (GIGO) problem. Although all three inputs are a source of estimation error in MVO, expected returns are particularly problematic, so we focus here on addressing the quality of the expected return inputs.
2. **Concentrated asset class allocations:** MVO often identifies efficient portfolios that are highly concentrated in a subset of asset classes, with zero allocation to others; in other words, lowest calculated standard deviation is not the same thing as practical diversification.
3. **Skewness and kurtosis:** MVO analysis, by definition, only looks at the first two moments of the return distribution: expected return and variance; it does not take into account skewness or kurtosis. But empirical evidence suggests quite strongly that asset returns are not normally distributed: there is significant skewness and kurtosis in actual returns.

4. **Risk diversification:** MVO identifies an asset allocation diversified across asset classes but not necessarily the sources of risk. For example, equities and fixed-income securities are two different asset classes, but they are driven by some common risk factors, and diversifying across the two classes won't necessarily diversify those risk factors.
5. **Ignores liabilities:** MVO also does not account for the fact that investors create portfolios as a source of cash to pay for something in the future: individual investors are looking to fund their consumption spending in retirement, for example, while pension funds are focused on funding the pension liability and repaying employees the retirement benefits promised to them. A more robust approach needs to account for the factors that affect these liabilities and the correlations between changes in value of the liabilities and returns on the asset portfolio.
6. **Single-period framework:** MVO is a single-period framework that does not take into account interim cash flows or the serial correlation of asset returns from one time period to the next. This means it ignores the potential costs and benefits of rebalancing a portfolio as capital market conditions change and asset allocations drift away from their optimal starting point.

We address critiques 1 through 4 in this LOS; critique 5 in LOS 4.j, 4.k, and 4.l; and critique 6 in LOS 4.g and 4.o.

The first two criticisms of MVO—GIGO and concentrated asset class allocations—can be addressed by improving the quality of the inputs, particularly expected return.

MODULE 4.2: REVERSE OPTIMIZATION AND BLACK-LITTERMAN



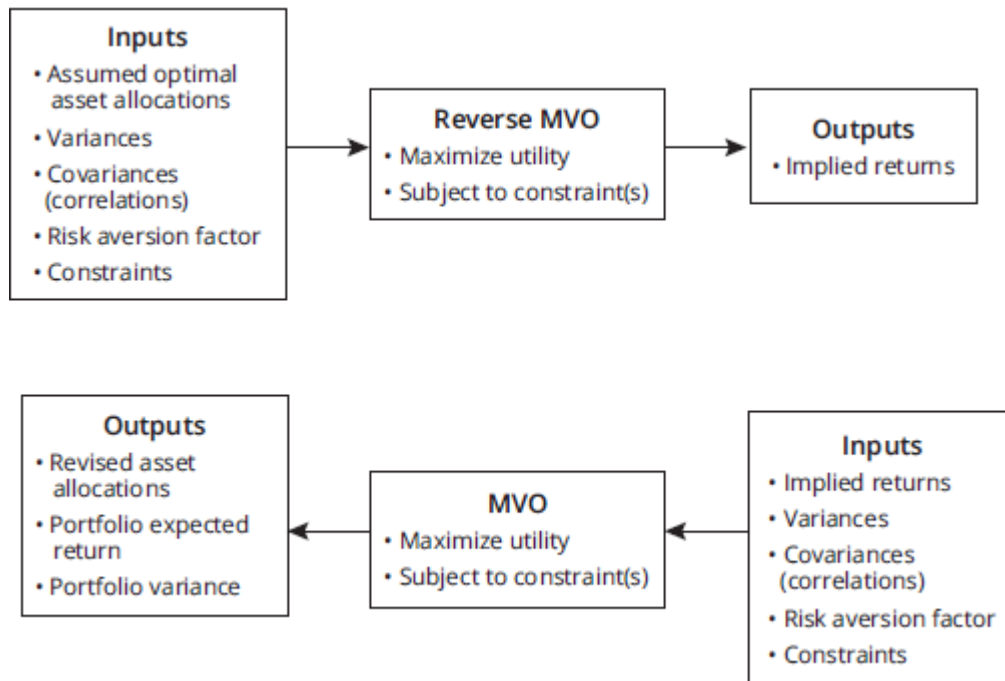
Video covering
this content is
available online.

Improving the Quality of the Inputs

Reverse optimization (Black-Litterman is an extension of this) can be used to improve the return estimates.

Reverse optimization is just what it sounds like: instead of starting with expected returns (and the other inputs) and deriving optimal portfolio weights, start with what we assume to be “optimal” portfolio weights from the global market portfolio and derive the expected returns consistent with those weights. Then we use these return estimates (called implied returns) to do a traditional MVO and derive optimal portfolio weights for our particular investor. This process is depicted in Figure 4.3.

Figure 4.3: Reverse Optimization

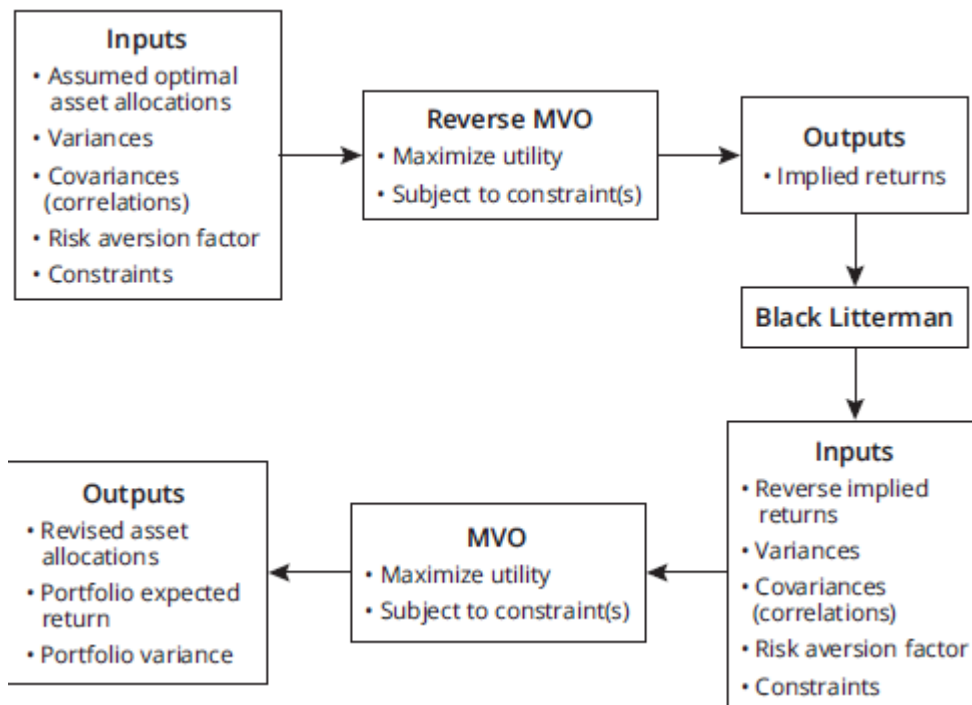


It is common to assume the world market portfolio provides optimal diversification and is therefore the appropriate starting point for weights to use in reverse optimization. The advantage of this is the derived returns already reflect a highly diversified portfolio and you avoid the tendency of MVO to come up with highly concentrated (in a few asset classes) allocations. Other starting points are possible, such as the weights from an existing IPS of the client.

The **Black-Litterman model** is an extension of reverse optimization in which the implied returns (actually implied excess returns) from a reverse optimization are subsequently adjusted to reflect the investor's unique views of future returns. For example, if reverse optimization:

- Derives an expected return for emerging market equities of 6.5% and you believe this is too low, you could adjust the expected return by 75 basis points to 7.25%. You can then rerun the MVO using your adjusted return estimates.
- Projects a return for U.K. large-cap equities of 8.2% and U.S. large-cap equities of 8.0% (a return differential of 20 basis points) and you believe that U.S. large-cap equities will outperform U.K. large-cap equities by 100 basis points, adjust the differential. Figure 4.4 displays a schematic view of the Black-Litterman model.

Figure 4.4: Black-Litterman Model



MODULE 4.3: EXAMPLE



LOS 4.b: Recommend and justify an asset allocation using mean-variance optimization.

Video covering this content is available online.

LOS 4.d: Recommend and justify an asset allocation based on the global market portfolio.

EXAMPLE: Recommending and justifying an asset allocation using MVO

Marsha Bronsten has come to her investment adviser for help to determine an appropriate asset allocation. The adviser discerns in conversations with Bronsten that her risk tolerance is average ($\lambda = 4$) and that she would also like to minimize the chance of earning less than 3%. The available asset allocations are as follows:

	Expected Return	Variance
Allocation 1	8%	0.0225
Allocation 2	6%	0.0144
Allocation 3	4%	0.0025

Recommend which of the three strategic asset allocations is appropriate for Bronsten.

Answer:

The first step is to calculate the certainty-equivalent return for each allocation using the equation $U_m = E(R_m) - 0.5 \times \lambda \times \text{Var}_m$.

$$U_1 = 0.08 - 0.5 \times 4 \times 0.0225 = 0.0350 = 3.50\%$$

$$U_2 = 0.06 - 0.5 \times 4 \times 0.0144 = 0.0312 = 3.12\%$$

$$U_3 = 0.04 - 0.5 \times 4 \times 0.0025 = 0.0350 = 3.50\%$$

Based solely on the criteria of the certainty-equivalent return, Bronsten is indifferent between Allocations 1 and 3, but prefers them both to Allocation 2. The second step is to calculate Roy's safety-first criterion, which is equal to $\frac{R_P - R_L}{\sigma_P}$ and identifies the portfolio with the highest probability of exceeding the threshold return of $R_L = 3\%$.

$$\text{Allocation 1: } \frac{0.08 - 0.03}{\sqrt{0.0225}} = 0.33$$

$$\text{Allocation 3: } \frac{0.04 - 0.03}{\sqrt{0.0025}} = 0.2$$

Allocation 1 has a higher probability of exceeding the threshold return than Allocation 3, so the adviser should recommend Allocation 1 to Bronsten.

Note that the data was given in a mixture of percent and decimal forms. The solution converted all data to decimal form. You could have also converted everything to percent form. For example:

$$U_1 = 8.00 - 0.005 \times 4 \times 225 = 3.50\%$$

$$\text{Allocation 1: } \frac{8-3}{\sqrt{225}} = 0.33$$

The ranking and conclusions will be the same. The approach you take is just personal preference.

EXAMPLE: Recommending and justifying an asset allocation using MVO

The Plowshare University endowment fund has an annual return objective of 9%, which is sufficient to cover its spending rate, expected inflation, and cost of earning investment returns. Its risk objective is to minimize risk (as measured by standard deviation of returns) while meeting its minimum expected return objective. The table provides the output from an MVO with a budget constraint and a nonnegativity constraint. Allocations AA, BB, CC, and DD can also be referred to as corner portfolios.¹

	Expected Return	Standard Deviation of Returns
Allocation AA	15%	24%
Allocation BB	18%	27%
Allocation CC	12%	20%
Allocation DD	10%	14%

The risk-free rate is 3%. If the client and manager believe a true risk-free asset exists and can be used to construct the SAA, **identify** the appropriate asset allocation for Plowshare and **calculate** the risk of the optimal allocation.

Answer:

The first step is to calculate the Sharpe ratio for each allocation.

$$\text{Sharpe ratio AA} = \frac{15\% - 3\%}{24\%} = 0.5$$

$$\text{Sharpe ratio BB} = \frac{18\% - 3\%}{27\%} = 0.56$$

$$\text{Sharpe ratio CC} = \frac{12\% - 3\%}{20\%} = 0.45$$

$$\text{Sharpe ratio DD} = \frac{10\% - 3\%}{14\%} = 0.5$$

The optimal risk allocation is BB as it has the highest Sharpe ratio.

The second step is to calculate the mix between BB and the risk-free asset assuming the return objective is 9%. Allowing w_{BB} to be w is calculated as follows:

$$9\% = 18\%(w) + 3\%(1 - w)$$

$$9 = 18w + 3 - 3w$$

$$6 = 15w; \text{ therefore, } w_{BB} = 0.40$$

The optimal portfolio invests 40% in Allocation BB and 60% in the risk-free asset.

The risk (standard deviation) of the optimal portfolio is as follows:

$$\sigma_{BB} \times w_{BB} = 27\% \times 0.40 = 10.8\%$$



MODULE QUIZ 4.1, 4.2, 4.3

- Which of the following methods is *most appropriate* for addressing highly concentrated allocations in portfolios?
 - Reverse optimization.
 - Monte Carlo simulation (MCS).
 - Liability-relative MVO.
- Jane Cullis is considering three potential asset allocations. She wishes to earn a nominal return of no less than 4%, and she has a high risk tolerance with a lambda of 2.

The following asset allocations are available:

	Expected return	Variance
Allocation 1	6%	0.02
Allocation 2	8%	0.03
Allocation 3	10%	0.04

Based on the information provided, which of the following allocations should Cullis choose?

- Allocation 1.
 - Allocation 2.
 - Allocation 3.
- Melody Chan is considering three potential asset allocations. She wishes to earn a nominal return of no less than 4% and maximize her chances of exceeding a 4% return.

The following asset allocations are available:

	Expected return	Variance
Allocation 1	6%	0.02
Allocation 2	8%	0.09
Allocation 3	10%	0.16

Based on the information provided, which of the following allocations would Chan *most likely* choose?

- A. Allocation 1.
- B. Allocation 2.
- C. Allocation 3.

MODULE 4.4: ISSUES FOR INDIVIDUALS



Video covering this content is available online.

LOS 4.c: Interpret and evaluate an asset allocation in relation to an investor's economic balance sheet.

So far, we have only considered tradable financial assets such as equities and bonds. However, a significant portion of the typical investor's asset portfolio is human capital, as well as the residential real estate property the investor owns and lives in. We can adapt the MVO framework to incorporate these kinds of assets into the analysis.

For investors who have stable jobs with consistent wages that increase with inflation, we can model the cash flows associated with human capital (future wages) as an inflation-linked bond. For individuals with less certain and more volatile future wages, we could model their human capital as a mix of inflation-linked bonds, equities, and corporate bonds. By including this source of economic value in the investor's portfolio, the individual's capacity to take on additional risk is increased. Because human capital is not tradable, one of the constraints must be to set the percentage allocation to human capital at whatever it is currently valued at in relation to the investor's total portfolio value.

Residential real estate owned by the investor can be treated in a similar fashion, with return and risk inputs estimated using a residential real estate property index for the investor's geographic region. Once again, the allocation to the property must be constrained to its current value as a percentage of the investor's total portfolio.

Because human capital and residential real estate property are two large but often overlooked components of an investor's total investment portfolio, including them in the analysis along with traditional investment vehicles increases the investor's capacity to bear risk.

LOS 4.e: Discuss the use of Monte Carlo simulation and scenario analysis to evaluate the robustness of an asset allocation.

MCS can be used to:

- Address the limitations of MVO as a single-period model and the related issues of rebalancing and taxes in a multiperiod framework. In a single-period model, taxes

are easy to incorporate into the analysis, and rebalancing the portfolio is irrelevant. However, in a multiperiod framework, rebalancing to move toward a strategic allocation target will involve buying and selling investments that trigger taxable capital gains and losses. Also, investors will save (add) money into and spend money out of their portfolio, resulting in interim cash flows. It is relatively straight-forward to do this at each future point in an MCS.

- Guide individual investors to identify their risk tolerance level. MCS can be useful in illustrating the range and likelihood of possible outcomes given various assumptions. Clients planning for retirement can visually see how often and when they are likely to run out of money.



PROFESSOR'S NOTE

Monte Carlo simulation (MCS) has multiple uses. It is essentially a random number generator, but random means random within user-defined boundaries. We saw MCS used in resampling to generate a range of possible inputs for MVO where the range was around the best guess of inputs. Here, MCS is being used another way—to simulate multiple future return paths for a portfolio over time. The various paths are based around a best guess of expected return and risk for the portfolio.

LOS 4.f: Discuss asset class liquidity considerations in asset allocation.

Less-liquid asset classes like direct real estate, infrastructure, and private equity require a liquidity return premium to compensate the investor for the additional liquidity risk. However, these asset classes are difficult to include in MVO because:

- There are few indexes available that accurately track these illiquid investments, making it harder to find data to use for estimating return, risk, and correlations.
- Even where indexes exist to provide return data, they are generally not investable as a passive alternative to active management of these asset classes.
- The risk-return characteristics of a specific real estate, private equity, or infrastructure investment are different from those of its asset class. For example, investing in the infrastructure asset class (assuming it is possible) should reflect the characteristics of a portfolio of all infrastructure, with only systematic risk priced. However, any one infrastructure fund is not fully diversified and, therefore, its risk and return characteristics reflect both systematic and nonsystematic risk.

To address these issues:

- Exclude illiquid asset classes when running an MVO, but use them to meet separately set target asset allocations.
- Include the illiquid asset classes in MVO and model the inputs of the specific (not asset class) investments you plan to use (i.e., the risk estimate will be based on both nonsystematic and systematic).
- Include the illiquid asset classes in MVO using highly diversified asset class inputs, recognizing that the actual investments made may have different characteristics. The input estimates for this approach are normally made using reported alternative investment indexes. Such indexes are usually not pure representations

of the asset class but include characteristics of other asset classes as well. This violates the requirement that asset classes be mutually exclusive and biases the reported correlations upward.



MODULE QUIZ 4.4

1. Louise Davey is 26 years old and has just paid off her student loans from college and hopes to begin saving to accumulate a portfolio. She is currently set to begin a career as a licensed insurance salesperson, working primarily on a commission-based pay structure. Louise is an only child and will be the sole beneficiary of her parents' substantial estate, which she estimates she will receive in about 30 years. Based on the information provided, which of the following statements is *most accurate*?
 - A. Louise's human capital could likely be modeled as an inflation-linked bond.
 - B. Louise's capacity to bear investment risk is relatively high.
 - C. Louise's human capital is a small component of her total economic worth.
2. When dealing with illiquid assets, such as the investor's personal residence or a private company he owns, it is *most accurate* to say:
 - A. a liquidity premium reduces the assets' expected return.
 - B. the positions can be excluded when running mean variance optimization for the client.
 - C. use data on publicly available funds to model the specific characteristics of the client's holdings when running mean variance optimization for the client.
3. Which of the following methods is the *least appropriate* way of incorporating client risk preferences into asset allocations?
 - A. Specify additional constraints.
 - B. Specify a maximum return.
 - C. Use MCS.
4. Which of the following statements regarding MCS is *most accurate*?
 - A. MCS replaces mean variance optimization (MVO) by addressing the limitations of MVO.
 - B. There is a high level of consistency between the MCS tools available in the marketplace.
 - C. MCS is not necessary to model taxes and portfolio rebalancing in a single period.

MODULE 4.5: A RISK BUDGETING APPROACH



Video covering this content is available online.

LOS 4.g: Explain absolute and relative risk budgets and their use in determining and implementing an asset allocation.

The goal of risk budgeting is to maximize return per unit of risk, where we can define risk as total portfolio risk, active risk, or residual risk.

The marginal contribution to portfolio risk is the change in total portfolio risk for a small change in the asset allocation to a specific asset class. For those of you with calculus backgrounds, it's the partial derivative of risk with respect to changes in portfolio allocations. Absolute contribution to total risk (ACTR) is the asset classes' contribution to portfolio volatility.

By estimating each asset classes' marginal contribution to total risk (MCTR), we can (1) see what happens to portfolio risk as we change individual allocations, (2) identify optimal allocations, and (3) develop a risk budget.

Here are some useful formulas:

Marginal contribution to total risk:	$MCTR_i = (\text{beta of asset class}_i \text{ with respect to the portfolio})(\text{total portfolio risk as measured by standard deviation})$
Absolute contribution to total risk:	$ACTR_i = (\text{weight}_i)(MCTR_i)$
	$\% \text{ of risk contributed by position}_i = ACTR_i / \text{total portfolio risk}$

The optimal allocations to each asset class occur when the ratio of excess return to MCTR is equal for all asset classes and is equal to the portfolio Sharpe ratio.

A simple example of a portfolio with an optimal risk allocation is shown in Figure 4.5.

Figure 4.5: Optimal Risk Allocation Example

	Weight	Excess Return	Beta	MCTR	ACTR	% Contribution to Risk	Ratio of Excess Return to MCTR
U.S. equities	60%	6.50%	1.300	15.60%	9.36%	78.03%	0.417
U.S. bonds	30%	3.66%	0.732	8.78%	2.64%	21.97%	0.417
Cash	10%	0.00%	0.000	0.00%	0.00%	0.00%	
Total portfolio	100%	5.00%	1.000		12.00%	100.00%	

Note that the portfolio excess return is 5% (the weighted average of the excess returns of each asset class) and the portfolio standard deviation is 12%. Here are the calculations for U.S. equities:

$$MCTR_{\text{equities}} = 1.300 \times 12.00\% = 15.60\%$$

$$ACTR_{\text{equities}} = 0.60 \times 15.60\% = 9.36\%$$

$$\% \text{ contribution to total risk}_{\text{equities}} = 9.36\% / 12.00\% = 78.00\%$$

$$\text{ratio of excess return to } MCTR_{\text{equities}} = 6.5\% / 15.60\% = 0.417$$

Note also that the portfolio Sharpe ratio of $5\% / 12\% = 0.417$ is equal to the ratio of excess return to MCTR for both U.S. equities and U.S. bonds. Therefore, the 60/30/10 allocation is optimal from a risk-budgeting perspective.

LOS 4.h: Describe how client needs and preferences regarding investment risks can be incorporated into asset allocation.

We have discussed a number of ways to incorporate client risk preferences into the asset allocation:

- Specify additional constraints, such as setting limits on allocations to risky asset classes or setting a ceiling on portfolio risk. We did this in the Plowshare example.

- Specify a risk aversion factor for the investor, as we did in the first example with Marsha Bronsten when we assumed she was an average investor and her risk aversion factor was 4.
- Use MCS to illustrate to the investor the various wealth outcomes possible from assuming allocations with different levels of risk.

LOS 4.i: Describe the use of investment factors in constructing and analyzing an asset allocation.

Up to this point, our opportunity set of investments consisted of asset classes, such as equities, fixed income, REITs, etc. Another approach is to define the opportunity set as factors, such as market exposure, size, valuation, momentum, liquidity, duration, credit, and volatility.

This approach is consistent with fundamental factor return models, such as the Fama-French model, in which the factors are the market portfolio, size, and value-growth.

The factors themselves are zero-dollar investment portfolios that are long the better performing attribute and short the underperforming attribute. For example, there are three factors in the Fama-French model:

- A zero-dollar portfolio long in small stocks and short in large stocks (the size factor).
- A zero-dollar portfolio long in value (high book-to-market) stocks and short growth (low book-to-market) stocks (the value-growth factor).
- The market portfolio.

Because of the way the factors are formed, they are not highly correlated with each other or the market portfolio, which improves the risk-return tradeoff from the optimal portfolios and expands the efficient frontier.

Once the factor portfolios, their expected returns, variances, and covariances are identified, MVO can be used in the same manner as we've previously discussed to identify portfolios with optimal allocations to the factors.

Research comparing the results of MVOs using asset class exposures versus factor exposures indicates that when the two opportunity sets broadly reflect the same exposures (underlying assets), the resulting efficient frontiers are not significantly different (i.e., one approach is not clearly superior). The choice of approach depends on how you form capital market expectations (i.e., the space in which you operate). If you collect data and think in terms of asset class, allocate risk by asset class. If you collect data and think in terms of risk factors, allocate risk by risk factor.



MODULE QUIZ 4.5

1. The following portfolio is being analyzed. The data is incomplete and does not show other asset classes held in the portfolio.

	Weight	Excess Return	Beta
Canadian equities	50%	8.25%	1.19
Canadian bonds	15%	2.75%	0.88

The portfolio standard deviation is 10%.

Which of the following amounts is *closest* to the ratio of excess returns to marginal contribution to total risk (MCTR) for the Canadian equities within the portfolio?

- A. 0.313.
 - B. 0.595.
 - C. 0.693.
2. Regarding the use of investment factors in forming an asset allocation, it is *most accurate* to say:
- A. this method is superior to asset class-based allocations for institutional portfolios.
 - B. this method will replicate the allocations produced by asset class-based allocations for institutional portfolios.
 - C. factor exposures may be investable by forming a series of zero-dollar long/short portfolios.

MODULE 4.6: AN ALM APPROACH



Liability-Relative Asset Allocation

Video covering this content is available online.

In this section, we address critique 5 of MVO, that MVO as discussed so far does not address the relationship between the asset investment portfolio and the liabilities that the investor will repay using the cash flow from the asset portfolio. We will focus our attention here on institutional investors such as pension funds, insurance companies, and banks. All three have liabilities they are obligated to meet at some point in the future, and they face strict regulatory rules and penalties for failure to meet those obligations.

Let's use the example of a defined benefit (DB) pension plan to illustrate the key issues and provide some definitions. There are two components to a DB pension plan: the pension liability and the investment portfolio that is managed to meet the cash flow requirements of the liability. A pension plan promises workers a stream of payments upon retirement that is usually dependent on how long the employee has worked for the company, as well as the worker's salary in the last few years before retirement. The pension liability represents the present value (calculated at the appropriate discount rate) of those future retirement obligations of the plan.

The plan surplus and the funding ratio are calculated as follows:

plan surplus = market value of investment portfolio assets – present value of the pension liabilities

funding ratio = market value of assets / present value of liabilities

A pension plan is fully funded if the funding ratio = 1 (which means the plan surplus is 0). An underfunded plan has a funding ratio less than 1, and an overfunded plan has a funding ratio greater than 1.

The characteristics of the pension liability drive the return and risk requirements of the investment portfolio and ultimately the asset allocation decision. Furthermore, the analysis should recognize that the value of the assets and the liabilities are

driven by some of the same factors, so the correlations between changes in value of the two are important.

LOS 4.j: Describe and evaluate characteristics of liabilities that are relevant to asset allocation.

The following characteristics of liabilities are relevant to the asset allocation decision:

- Fixed versus contingent: Fixed liabilities have cash flows whose amount and timing are specified in advance, such as a fixed-rate corporate bond. Contingent liabilities have cash flows that depend on uncertain future events, such as the pension liability associated with a defined pension plan.
- Legal versus quasi-legal: Legal liabilities are obligations defined in a legal agreement. Quasi-legal liabilities are not legal obligations but are cash outflows expected to occur in the future and are essential to the mission of the institution. University endowments can be considered to have quasi-legal liabilities.
- Duration and convexity measure the change in value of a liability for a given change in interest rates. In the CFA curriculum, we typically talk about duration and convexity in relation to fixed-income securities, but the concept can be applied to any liability.
- Liability value versus size of sponsoring organization: A large liability in relation to the size of the sponsoring organization will necessarily be accounted for in the asset allocation decision; a small liability can usually be ignored as its effect on the optimal asset allocation is minimal.
- Factors that affect future cash flows: These factors include inflation, interest rates, risk premiums, and other economic conditions. DB pension obligations are influenced by the choice of the discount rate, for example.
- Timing considerations, including longevity risk.
- Regulations affecting the determination of the liability's value, typically found in the insurance industry.

LOS 4.k: Discuss approaches to liability-relative asset allocation.

LOS 4.l: Recommend and justify a liability-relative asset allocation.

We will discuss three approaches to liability-relative asset allocation. They are summarized here and then discussed in more detail:

- Surplus optimization: This is an extension of MVO in which we determine an efficient frontier based on the surplus with its volatility as our measure of risk, stated either in money or percentage terms.
- Two-portfolio approach: In this approach, we separate the asset portfolio into two subportfolios: a hedging portfolio and a return-seeking portfolio.
- Integrated asset-liability approach: This approach integrates both the assets and the liabilities in a joint optimization method.

Surplus Optimization

We can define the surplus return as:

$$R_{s,m} = \text{surplus return} = (\text{change in asset value} - \text{change in liability value}) / \text{initial asset value}$$

Then the objective function to maximize is:

$$U_m = E(R_{s,m}) - 0.005 \times \lambda \times \text{Var}_{s,m}$$

where:

$E(R_{s,m})$ = expected surplus return

$\text{Var}_{s,m}$ = variance of surplus return

We then proceed with the same MVO as previous, except we also include the expected returns and variances of the liabilities. The correlations reflect the extent to which the assets are useful to hedge the liabilities.

There are a number of ways to estimate the expected returns and variances of the liabilities. The first is to make the assumption that the liabilities behave like corporate bonds and the liability inputs can be estimated using the expected return and volatility of corporate bonds. The second is to use a factor approach and identify the common factors that affect both the asset classes and the liabilities.

Two-Portfolio Approach (Also Known as the Hedging or Return-Seeking Approach)

Conceptually this is a straight-forward approach. We create an asset portfolio that hedges the liabilities, and the remainder is managed independently using MVO to maximize utility and identify the optimal risk-return tradeoff.

The hedging portfolio can be created using the various techniques outlined elsewhere in the Level III curriculum fixed-income readings: cash flow matching, duration matching, and immunization.

This approach is most often used for insurance companies and overfunded pension plans that want to minimize the risk of underfunding.

This approach can be modified by (1) only partially hedging the liabilities and allocating more capital to the return-seeking portfolio or (2) increasing the allocation to the hedging portfolio as the funding ratio and the surplus increase. Both of these approaches are more aggressive than completely hedging the liabilities, as they trade off higher expected return for higher risk.

There are two limitations of this approach:

- If the funding ratio is less than one, it's difficult to create a hedging portfolio that completely hedges the liabilities.
- A hedging portfolio may not be available to hedge certain kinds of risk (like earthquakes).

Integrated Asset-Liability Approach

The distinctive feature of the previous two approaches is that the composition of the liabilities is already in place when the asset allocation decisions are made, so the two decisions are made independently. Banks, hedge funds with short positions, and

insurance companies, however, make decisions about the composition of their liabilities jointly with their asset allocation decisions. There is a continuous feedback loop between the two, which requires a multiperiod model. This is often referred to as an integrated asset-liability approach.

For example, a key risk faced by large global banks, which are very highly leveraged, is whether the bank's capital is sufficient to absorb losses when their asset values decline, their liability values increase, or both. And as both bank assets (loans) and liabilities (deposits) are affected by changes in interest rates, although to varying degrees, stress testing requires a framework that can simultaneously account for both sides of the balance sheet. An integrated asset-liability approach is therefore necessary for banks to identify the optimal mix of assets and liabilities to meet their return and risk objectives.



MODULE QUIZ 4.6

1. Which of the following items is *best* described as a contingent liability?
 - A. A company's fixed-coupon debt.
 - B. An insurance company's obligations to pay policyholders.
 - C. Planned distributions by a foundation.
2. A bank is *most likely* to use which of the following approaches to liability-relative asset allocation?
 - A. Surplus efficient frontier approach.
 - B. Integrated asset-liability approach.
 - C. Two-portfolio approach.

MODULE 4.7: GOALS-BASED AND MISCELLANEOUS APPROACHES



Video covering this content is available online.

LOS 4.m: Recommend and justify an asset allocation using a goals-based approach.

The **goals-based approach** to asset allocation is useful for individual investors, who typically have a number of (sometimes conflicting) objectives, with different time horizons and different levels of urgency, which we will measure as specified required probabilities of success. For example, an individual investor might define one goal as saving enough for college tuition in 10 years and specify that she requires a 90% probability of success, while another goal is having \$1,000,000 in 30 years to set up a foundation when she retires, with a 60% probability of success. The first goal in this case is more urgent than the second goal.

In this approach:

- The investor's portfolio is composed of subportfolios, and each investment goal is addressed individually with these subportfolios.
- Taxable and tax-exempt investments are part of the opportunity set.
- Instead of expressing an investment goal as an expected average return on the portfolio, we identify and document "minimum expectations" for each goal, which

is the minimum expected return necessary to provide a specified minimum required probability of success over the given time horizon.

Often, the advisor will select from a set of pre-established subportfolios (modules) to meet specific goals of a client rather than create new subportfolios for each client. The modules are distinguished by differences in risk-return tradeoffs, liquidity requirements, and the inclusion or exclusion of certain asset classes.

The asset allocation is determined by identifying, for each goal, the module that provides the highest expected return with the specified probability of success over the required time horizon. Then the size of the investment in that module is simply the present value of the future goal discounted at the expected return of that module. The portfolio allocation is then the sum of all of the individual investments necessary to achieve each goal.

EXAMPLE: Goals-based approach

An investor has a goal of having \$500,000 to fund his daughter's undergraduate and graduate education beginning in 10 years with a 90% required probability of success. He also has a goal of transferring \$6,000,000 to his daughter in 30 years with a required probability of success of 75%.

The modules in the table are available to the adviser to implement each of these goals.

	Module A	Module B	Module C
Expected return	5%	6%	8%
Expected volatility	4%	7%	14%

The annual minimum expectation returns at various probabilities of success over the 10-year time horizon are as follows:

Required Success	Module A	Module B	Module C
90%	3.0%	2.4%	-2.2%
75%	3.6%	3.8%	1.7%

The annual minimum expectation returns at various probabilities of success over the 30-year time horizon are as follows:

Required Success	Module A	Module B	Module C
90%	4.0%	4.3%	4.7%
75%	4.1%	4.8%	5.2%

Determine the module to use and **calculate** the amount to invest in that module to meet each goal. Treat each goal separately.

Answer:

For the first goal, Module A has the highest return given a 90% required probability of success of 3.0% over the 10-year time horizon. The investment necessary today in Module A to fund the \$500,000 college tuition in 10 years is the present value of \$500,000 discounted at 3.0% for 10 years, or \$372,047.

For the second goal, Module C has the highest return given a 75% required probability of success of 5.2% over the 30-year time horizon. The investment

necessary today in Module C to fund the \$6,000,000 transfer in 30 years is the present value of \$6,000,000 discounted at 5.2% for 30 years, or \$1,311,231.

LOS 4.n: Describe and evaluate heuristic and other approaches to asset allocation.

There are additional approaches to optimal asset allocation that are ad hoc and not based on theoretical models and don't require sophisticated mathematics, but also don't necessarily lead an optimal allocation in the way in which we have defined it up to this point.

120 Minus Your Age

This one is easy. It relates your age to your allocation to equities so that $120 - \text{age} = \%$ allocation to equities, with the remainder going to fixed incomes. That means a 40-year-old woman would have an 80/20 split between stocks and bonds, and when she is 50, it would be 70/30.

It's consistent with the idea that as the value of human capital declines as we age, our capacity to bear risk in the rest of the portfolio declines, suggesting that we move from equities into fixed incomes. What's interesting about this approach is that it seems to come close to mimicking the allocations of target-date retirement funds.

60/40 Split

This one is even easier than the 120-minus-your-age rule. You simply maintain your asset allocation at 60% stocks and 40% bonds. This is not nearly as off-the-wall as it sounds, as the global financial asset portfolio has historically been split approximately 60/40 between stocks and bonds.



PROFESSOR'S NOTE

I guess the assumption with this method is that you are 60 years old throughout your entire life!

Endowment Model or Yale Model

Under this approach, you allocate larger amounts to alternative investment asset classes (private equity, real estate, or natural resources) than is typically recommended by a strict MVO. Presumably these markets are less-than-perfectly informationally efficient, so investment managers with expertise in these markets can outperform expectations. Also, they are less liquid, and certain institutional investors are positioned to take on additional liquidity risk in return for a liquidity premium because of their longer time horizons. The approach is popular with university endowment funds.

Risk Parity

The idea with the risk parity asset allocation approach is that diversification is achieved by ensuring that each asset class contributes the same amount to the total

portfolio risk. This addresses critique 4 of MVO that diversification across asset classes does not guarantee diversification across risk sources. The criticism of this approach is that it ignores expected returns and focuses only on risk.

1/N Rule

If we create an equally weighted portfolio in which we allocate the same percentage to each asset class, we have in effect weighted each class by $1/N$, where N is the number of classes. For example, with 8 asset classes, this approach suggests we invest $1/8 = 12.5\%$ in each class. One common method is to rebalance to equally weighted each quarter. Although it sounds very simple, there is some empirical evidence that this type of approach actually performs better than we would expect.

MODULE 4.8: REBALANCING POLICY



LOS 4.o: Discuss factors affecting rebalancing policy.

Video covering this content is available online.

Investment managers rebalance portfolios for a number of reasons, including in response to changing client goals and capital market expectations or changes in tactical allocations. Here we will stick to the CFA curriculum definition: adjusting asset allocations to move toward the originally defined strategic allocation goal. Percentage range rebalancing involves setting trigger points around the optimal percentage allocation and rebalancing back to the target allocation or partially correcting when those trigger points are hit.

The key factors that impact the optimal corridor width (or the rebalancing range) of an asset class include transaction costs, risk tolerance, correlations with the rest of the portfolio, and the volatility of the rest of the portfolio.

The higher the transaction costs, the wider the optimal corridor, as the benefits of rebalancing have to “pay” for higher costs to rebalance. The higher the investor’s risk tolerance, the wider the corridor, because the investor is less concerned about deviations from the optimal allocation. The higher the correlation of the asset class with the rest of the portfolio, the wider the corridor, because a portfolio tends to move with the asset class, and the allocations tend to stray more slowly from the target. Finally, the higher the volatility of the asset classes, the narrower the optimal corridor. This is because higher volatility increases the likelihood that the actual allocation will diverge over time from the target allocation.

Ultimately, the choice of corridor width depends on a trade-off between risk control, transaction costs, and correlations between classes. In complex situations, a quantified cost-benefit analysis will be required.



MODULE QUIZ 4.7, 4.8

1. Which of the following statements regarding subportfolios within the context of the goals-based approach to asset allocation is *most accurate*?
 - A. The most significant difference between the subportfolios is the return-risk tradeoff.
 - B. Higher priority goals require higher return assets.

- C. The size of the investment in a particular subportfolio is the present value of the future goal discounted by the risk-free rate.
2. Which of the following statements regarding the “120 minus your age” heuristic is *most correct*?
- A. A 70-year-old individual should have 50% of the investment portfolio invested in equity securities.
- B. A 60-year-old individual should have 60% of the investment portfolio invested in fixed-income securities.
- C. The approach generally does a poor job of mimicking the allocations of target-date retirement funds.
3. A portfolio has invested in Asset Class Z and the manager is setting the optimal rebalancing corridor. The corridor will be wider if:
- A. the rest of the portfolio is highly volatile.
- B. the correlation of Z with the rest of the portfolio is highly positive.
- C. transaction costs are low.

KEY CONCEPTS

LOS 4.a

Given an opportunity set of investable assets, their expected returns and variances, as well as the pairwise correlations between them, MVO identifies the portfolio allocations that maximize return for every level of risk. If we assume the opportunity set includes all assets, the result is the efficient frontier.

MVO is criticized for:

1. **GIGO:** The quality of the output from the MVO (portfolio allocations) is highly sensitive to the quality of the inputs.
2. **Concentrated asset class allocations:** MVO often identifies efficient portfolios that are highly concentrated in a subset of asset classes.
3. **Skewness and kurtosis:** These are ignored.
4. **Risk diversification:** MVO identifies an asset allocation diversified across asset classes, but not necessarily the sources of risk.
5. **Ignores liabilities:** MVO also does not account for the fact that investors create portfolios as a source of cash to pay for something in the future.
6. **Single-period framework:** MVO is a single-period framework that does not take into account interim cash flows or the serial correlation of asset returns from one time period to the next.

LOS 4.b, 4.d

MVO provides an efficient frontier of asset allocation choices. However, the allocation selected will depend on the specific investor:

- How do they quantify return to risk?
- Do they require specific assets or asset classes to be excluded or included?
- Do they use an asset-only, liability-relative, or goals-based approach?

Variations on MVO may be used:

- Reverse optimization solves for expected return by asset class based on the classes' weights in the world market portfolio and uses those consensus return

expectations to determine asset allocation for an investor.

- Black-Litterman allows the manager to view adjust those consensus return expectations.
- MCS complements MVO; MCS is covered later.

LOS 4.c

A significant portion of the typical investor's asset portfolio is human capital and also the residential real estate property the investor owns and lives in. We can adapt the MVO framework to incorporate these kinds of assets into the analysis by estimating the expected return and risk inputs for these assets and constraining the allocations to match current values.

LOS 4.e

Monte Carlo simulation can be used to (1) address the limitations of MVO as a single-period model and the related issues of rebalancing and taxes in a multiperiod framework and (2) guide individual investors to identify their risk tolerance level.

LOS 4.f

Less-liquid asset classes like direct real estate, infrastructure, and private equity require a liquidity return premium to compensate the investor for the additional liquidity risk.

LOS 4.g

The goal of risk budgeting is to maximize return per unit of risk, where we can define risk as total portfolio risk, active risk, or residual risk.

LOS 4.h

Ways to incorporate client risk preferences into asset allocation include:

- Specifying additional constraints.
- Specifying a risk aversion factor for the investor.
- Using Monte Carlo simulation.

LOS 4.i

Investment factors can be used in asset allocation by defining the opportunity set as risk factors that affect expected return. Such factors include market exposure, size, valuation, momentum, liquidity, duration, credit, and volatility.

LOS 4.j

The following characteristics of liabilities are relevant to the asset allocation decision:

- Fixed versus contingent.
- Legal versus quasi-legal.
- Duration and convexity.
- Liability value versus size of sponsoring organization.
- Factors that affect future cash.
- Timing considerations.
- Regulations affecting the determination of the liability's value.

LOS 4.k, 4.l

There are three common approaches to liability-relative asset allocation.

- Surplus optimization: Use MVO to determine an efficient frontier based on the surplus with its volatility as our measure of risk, stated either in money or percentage terms.
- Two-portfolio approach: Separate the asset portfolio into two subportfolios: a hedging portfolio and a return-seeking portfolio.
- Integrated asset-liability approach: Jointly optimize the selection of both the assets and the liabilities.

LOS 4.m

The goals-based approach is useful for individual investors, who typically have a number of (sometimes conflicting) objectives, with different time horizons and different levels of urgency.

- The investor's portfolio is composed of subportfolios, and each investment goal is addressed individually with these subportfolios.
- Taxable and tax-exempt investments are part of the opportunity set.
- Minimum expectations are specified for each goal.

LOS 4.n

Additional ad hoc approaches to asset allocation include:

- 120 minus your age.
- 60/40 split.
- Endowment model or Yale model.
- Risk parity.
- 1/N rule.

LOS 4.o

The following indicate wider corridors for asset classes:

- Higher transaction costs.
- Higher investor risk tolerance.
- Higher correlation of the asset class with the rest of the portfolio.
- Higher volatility of asset classes indicates a narrower corridor to control risk.

Ultimately, the choice of corridor width depends on a trade-off between risk control, transaction costs, and correlations between classes. In complex situations, a quantified cost-benefit analysis will be required.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 4.1, 4.2, 4.3

1. **A** Reverse optimization is most likely to produce a more diversified portfolio because it starts with the weights of all assets in the global world market portfolio and solves for the consensus expected returns consistent with that highly diversified portfolio. MCS does not address this issue at all because it is used to model behavior over time of any one specific asset allocation. Liability-

relative MVO is focused on the change in value of the surplus (PVA – PVL). Resampled MVO is another way to address the concentration issue, but that was not a choice. (Module 4.2, LOS 4.a)

2. **C** Step 1 is to exclude any portfolios that do not meet the 4% minimum return objective. Next, calculate the certain equivalent returns:

$$\text{Allocation 1: } 0.06 - (0.5 \times 2 \times 0.02) = 0.04$$

$$\text{Allocation 2: } 0.08 - (0.5 \times 2 \times 0.03) = 0.05$$

$$\text{Allocation 3: } 0.10 - (0.5 \times 2 \times 0.04) = 0.06$$

Allocation 3 has the highest certainty-equivalent return, so it should be chosen by Cullis. (Module 4.1, LOS 4.a)

3. **C** Step 1 is to exclude any portfolios that do not meet the 4% minimum return objective. Next, calculate the safety-first ranking to determine highest probability of exceeding the 4%:

$$\text{Allocation 1: } (0.06 - 0.04) / (0.02)^{1/2} = 0.141$$

$$\text{Allocation 2: } (0.08 - 0.04) / (0.09)^{1/2} = 0.133$$

$$\text{Allocation 3: } (0.10 - 0.04) / (0.16)^{1/2} = 0.150$$

Allocation 3 has the highest probability of exceeding the threshold return. (Module 4.3, LOS 4.d)

Module Quiz 4.4

1. **B** She is young, starting a job, and apparently debt free. A high ability to take risk is plausible. She appears to have no financial capital, so human capital (the new job) appears to be her only capital. Her HC is somewhat riskier and uncertain, so not at all like an inflation-linked bond, which would require her income to be linked directly to changes in inflation. (LOS 4.c)
2. **B** Ignoring the positions and running MVO for the rest of the client's portfolio is a method of dealing with such preexistent positions. This essentially recognizes the client will not sell such positions. Two other methods exist. Include the positions in MVO by (1) modeling the specific characteristics of what that client actually owns, or (2) using data on public funds but realizing that such data will not reflect the specific characteristics of the client's positions. However, you cannot use public data to model the highly specific characteristics of what the client owns. Also, a liquidity premium increases expected return. (LOS 4.f)
3. **B** The reading lists three methods: specifying additional constraints, specifying a risk aversion factor for the investor, and using MCS. (LOS 4.e)
4. **C** In a single-period model, taxes are easy to incorporate into the analysis, and rebalancing the portfolio is irrelevant. Therefore, MVO can address taxes in a single-period model and MCS is not necessary. MCS becomes useful in dealing with a multi-period framework, where the analysis of taxes and rebalancing becomes much more mathematically challenging otherwise.

MCS *complements* (does not replace) MVO by addressing the limitations of MVO as a single-period framework.

MCS tools can be quite different. They vary significantly in their ability to model non-normal returns, serial correlations, tax rates, and non-traditional investments, for example. (LOS 4.e)

Module Quiz 4.5

1. **C** $MCTR_{equities} = 1.19 \times 10\% = 11.9\%$

Ratio of excess return to $MCTR_{equities} = 8.25\% / 11.9\% = 0.693$

(LOS 4.g)

2. **C** Not all factors are replicable, but the ones that are can be obtained with a position that is long the desired factor (e.g., growth) and short the undesired factor (e.g., value). Neither asset class-based allocation nor factor-based allocation is superior. It is a matter of which method better resonates with how the manager looks at investing, not the kind of client. (LOS 4.i)

Module Quiz 4.6

1. **B** Insurance company obligations to policyholders are typically contingent (uncertain in timing, amount, or both) liabilities (a legal obligation to pay). Fixed-coupon debt is a fixed obligation to pay, and foundation distributions are not legal liabilities (but may be regarded as quasi liabilities). (LOS 4.j)
2. **B** A bank can typically vary the nature of both its assets and liabilities. A joint optimization (deciding how to set up both) is common. The other approaches take the liabilities as a given and only focus on managing the assets. (LOS 4.l)

Module Quiz 4.7, 4.8

1. **A** The priority of the goal determines the amount of risk taken. Thus, you expect significant differences in risk and return between subportfolios. The allocation to a subportfolio is the future need discounted by the expected return of the assets used in that subportfolio, not by risk-free rates. High-priority goals require more certainty and would be funded by lower, not higher, risk and return assets. (Module 4.7, LOS 4.m)
2. **A** The percentage allocation to equities is based on 120 minus your age. Such an approach has been found to come close to mimicking the allocations of target-date retirement funds. (Module 4.7, LOS 4.n)
3. **B** High correlation allows wider corridors because if the assets move in sync, divergence between them is less likely. Low transaction costs allow narrower corridors because the cost of rebalancing is reduced. High volatility in either Z or the rest of the portfolio increases risk and calls for narrower corridors. (Module 4.8, LOS 4.o)

¹ See Level III CFA Curriculum Reading "Principles of Asset Allocation," footnote 6.

READING 5

ASSET ALLOCATION WITH REAL-WORLD CONSTRAINTS

EXAM FOCUS

Asset allocation is not an exercise in abstract math. This reading continues the discussion of practical considerations that may arise. Be prepared to recognize the potential impact of the issues discussed on a particular client's asset allocation.

MODULE 5.1: REAL WORLD ISSUES



LOS 5.a: Discuss asset size, liquidity needs, time horizon, and regulatory or other considerations as constraints on asset allocation.

Video covering this content is available online.

Additional Constraints When Choosing an Optimal Asset Allocation

Asset Size

Smaller funds often lack the expertise and governance structure to invest in complex strategies, and therefore, often face a problem of how to achieve an adequate level of diversification. In addition, many capital markets impose local legislation, restricting investment in some assets to investors with a given level of capital or experience. Smaller funds may use commingled investment accounts (pooling money from a small group of investors) to achieve adequate size to diversify. To enable investment in assets where local legislation requires minimum investment levels, families may pool their assets to qualify.

Larger portfolios can generally access greater management expertise in the governance capacity, allowing them to consider complex strategies that smaller funds cannot. Their larger capital base also enables investment in accounts with relatively high minimum investment requirements. This allows large funds to achieve higher levels of diversification.

Large portfolios benefit from economies of scale via cost savings regarding internal management and greater negotiating power regarding management fees, allowing higher allocations to alternative investments. As the size of the fund increases, the *per-participant* cost of the internal governance infrastructure decreases, giving the

fund a competitive advantage in private equity, hedge fund, and infrastructure investing.

Funds that are too large may not be able to take advantage of asset classes that lack the capacity to absorb large amounts of funds. For example, active equity strategies involving small-cap stocks may be less suitable because the size of investment can be too large for an external manager to take on. A small-cap manager may suffer diseconomies of scale as: larger trades have increased price impact, the inflow of capital may encourage managers to abandon their core strategies, and the need for increased numbers of staff may slow the decision-making process. A potential solution is to split the allocation among several managers, but identifying and monitoring suitable managers is an added burden and cost. The result is that large funds often take a passive approach in such situations.

Very large funds may find that there are not enough alternative investments (e.g., too few hedge funds) available and may choose a fund-of-funds (FoF). But this carries a double fee structure for the FoF manager and the underlying fund managers. In addition, the strategies of one hedge fund manager may be offset by strategies of another manager.

Liquidity Needs

The key to successfully addressing the liquidity constraint for a portfolio is to integrate the needs of the owner and the characteristics of the asset class. Some owners require extremely high levels of liquidity and hence typically invest in high-quality, short-term, liquid assets. Other owners with lower needs and much longer time horizons can take advantage of the illiquidity premium inherent in alternative investments, such as real estate and infrastructure.

The following table summarizes the typical liquidity needs of a range of portfolio owners.

Portfolio Owner	Typical Liquidity Needs
Banks	High liquidity needed to support day to day operations and stand ready to repay deposits
Sovereign Wealth Funds, Endowments, Pension Plans, Foundations	Longer time horizons and lower liquidity needs
Property and Casualty Insurance	Relatively high due to unpredictability of claims
Life and Auto Insurance	Relatively low due to predictability of claims
Individuals	Varies by individual circumstance

But there are always case-specific exceptions, such as a bank with highly liquid loan assets that can provide necessary liquidity that is normally provided by the investment portfolio or a foundation supporting research that requires high liquidity to fund potential but unpredictable breakthrough research opportunities.

The possibility of extreme market conditions should also be considered when planning liquidity levels. Investor behavior changes during times of stress, and a successful allocation should take account of the resulting change in cash flows. Portfolio governance is also important in this context. In times of stress, unsophisticated investors may panic sell assets, leading to permanent losses and lower total returns from the capital base when returns revert to precrisis levels.

Time Horizon

A portfolio's time horizon is defined by a liability to be paid or a goal to be funded at a future date. Asset allocations must consider the horizons defined by each liability and goal, as well as adapting to the changing mix of assets and liabilities as time progresses. The value of human capital, for example, declines over time. As a result, the asset allocation will likely shift towards lower risk asset classes such as fixed income.

The changing nature of liabilities over time also requires changes in asset allocation. A pension fund catering for a young workforce, for example, would be heavily invested in long-term bonds. A more mature scheme would move towards intermediate and short-term bonds.

The time horizon is also associated with the ability to take on risk. Portfolios with longer time horizons are often invested in assets with higher risk. There is evidence that risky asset returns mean revert over time, evening out below and above average levels of return. This concept is known as time diversification.

Asset allocations for individual investors also change over time, as illustrated in the following examples.

EXAMPLE: Older retired individual

Barry Garland is 70 years old and recently retired. He has two goals that require funding from his current portfolio:

- Goal 1: To maintain a constant standard of living to age 85.
- Goal 2: To maintain a constant standard of living from age 85 to 100.

Goal 1 is fully funded, but Goal 2 is only partially funded. Barry's life expectancy at age 70 is 17.5 years.

Goal 1 will have the higher priority as his chances of living decline as he ages.

Goal 1 is fully funded and higher priority so the subportfolio will emphasize more conservative investments.

Goal 2 is of a lower priority and currently not fully funded. This subportfolio can be invested more aggressively with more growth potential.

EXAMPLE: Families with multiple funding goals

Jane and Arthur Bigstone are both 52 years old and work as lawyers in their home town. The Bigstones have a daughter, Alice, age 16, who they intend to send to college, and a son Mark, a promising young politician, age 27, who aims to run for mayor of the nearest city in 8 years. If their financial situation allowed it, they would like to make a donation to any campaign he ran. They would also like to set up a scholarship at the local school to fund talented children from underprivileged neighborhoods. Ideally, they would like to do this when they are 80 years old to celebrate the 40th anniversary of Arthur setting up his own practice.

The Bigstones have four goals for their portfolio:

1. Funding lifestyle and consumption needs.
2. Funding Alice's college education.
3. Donating to Mark's mayoral campaign.
4. Funding the scholarship.

A typical allocation could split the lifestyle/consumption goal into a worst-case scenario of reduced standard-of-living, a baseline case maintaining standard-of-living, and an aspirational case where the standard-of-living improves. This would mean the Bigstones would have 6 subportfolios with risk preferences similar to those shown in Figure 5.1.

Figure 5.1: Subportfolios

Goals	Risk	Allocation	% of Total Portfolio
Minimum	Conservative	100% Bonds & Cash	65%
Maintain	Moderate	60% Equity & 40% Bonds	12%
Aspirational	Aggressive	100% Equity	8%
College Fund	Conservative	100% Bonds & Cash	6%
Campaign Donation	Aggressive	100% Equity	6%
Scholarship	Aggressive	100% Equity	3%
Aggregate		25% Equity & 75% Bonds	100%

In another 15 years, the allocation for the Bigstones would look very different. With fewer years of consumption to fund, the assets required to fund future consumption are much lower. The college and mayoral campaign have been funded and only the scholarship remains as an aspirational goal. The allocation may now look similar to Figure 5.2, assuming the goals as defined earlier have not changed. Clearly, as the Bigstones' children grow up and pursue careers, it is entirely possible that new goals (e.g., a run for congress for Mark) would replace the aspirational goal of the scholarship.

Figure 5.2: Subportfolios 15 Years Later

Goals	Risk	Allocation	% of Total Portfolio
Minimum	Conservative	100% Bonds & Cash	60%
Maintain	Moderate	60% Equity & 40% Bonds	10%
Aspirational	Aggressive	100% Equity	6%
Scholarship	Aggressive	100% Equity	24%
Aggregate		35% Equity & 65% Bonds	100%



PROFESSOR'S NOTE

It should be evident the specific allocations shown are somewhat arbitrary. There is no formula to determine the numbers. Your task is to see the logic behind choosing a higher or lower allocation to equity, bond, and cash in one subportfolio relative to another.

Regulatory and Other External Constraints

Each portfolio faces its own set of regulatory and other external constraints. Several of these portfolios are addressed in the following.

Insurance Companies

Investment returns are a large contributor to the performance of an insurance company. The asset class with the largest allocation will be fixed income, reflecting the need for the insurer to match assets to the projected cash flows of the risks being insured. Local accounting laws often require fixed income investments to be stated at book value, so the insurer can focus primarily on the pattern of cash flow receipts rather than the volatility of market value.

The main risk considerations are the need to maintain enough capital to meet claims made by policyholders, along with factors that directly affect the company's financial strength metrics. These include:

- Risk-based capital measures.
- Liquidity.
- Yield levels.
- Credit ratings.
- Potential to liquidate assets to meet claims.

Local legislation often limits the allocation insurance companies can make to asset classes. Equity investment maybe limited to as little as 10%, with caps also placed on allocations to private equity investments and high-yield bonds.

Pension Funds

As well as capping the allocation to certain asset classes, local legislation often places a wide range of tax, accounting, reporting, and funding constraints on pension funds. There may be tax incentives offered to invest in domestic assets. Accounting rules may allow deferred recognition of losses.

These factors will be considered in the fund's decision on the level of risk exposure. The final asset allocation is likely to consider the anticipated funding cost, and the implication for the pension expense that is likely to be reported in the financial statements.

When considering funding as a constraint, the pension fund will compare the risk of funding cost exceeding a given threshold for the asset allocation (a risk the fund would like to minimize), to the present value of expected contributions (which the fund would also like to minimize).

For example, higher allocations to equities rather than bonds will increase the volatility of returns. In turn, this increases the risk that low returns increase the required contributions. However, there is a benefit in that the higher expected return would decrease the present value of expected contributions.

The fund will need to decide on the optimal combination of risk (that contributions exceed a given level) and return (as measured by the PV of expected contributions) while taking into account the external regulatory requirements and allocation limits.

Endowments and Foundations

Endowments and foundations are both assumed to have an infinite time horizon and are subject to very few regulatory constraints compared to other entities. In some countries, there may be a minimum required annual distribution or socially responsible investment required to maintain a tax-exempt status. The long time horizon usually allows investment in risky assets, but if the endowment is part of the funding of an organization, covenants placed on the organization by lenders may constrain the activities of the portfolio.

Sovereign Wealth Funds

Sovereign wealth funds are government-owned entities investing on behalf of the state, and are typically not looking to match assets and liabilities. They are, however, subject to scrutiny from the citizens of that state which may reduce the level of risk that their long time horizon would otherwise allow them to take on.

In addition, each fund self-governs by capping the allocation of funds to certain assets. The aim of these constraints may include:

- Minimum investment requirements in socially or ethically acceptable assets.
- Maximum investments in risky assets such as alternative investments.
- Limits on the investment allowed in certain currencies.

Investing in ethically acceptable assets involves considering environmental, social, and governance goals. This is usually not part of the initial asset allocation process. Rather, an allocation will be set aside and invested in acceptable assets.

LOS 5.b: Discuss tax considerations in asset allocation and rebalancing.

In the presence of taxation, pre-tax, after-tax risk, and return characteristics may be significantly different. For this reason, taxable entities should consider after-tax characteristics during the allocation process. Adjusting for taxes after allocations have been made may lead to suboptimal allocations.

Although each country has its own unique tax legislation, there are several common characteristics that should be noted.

- Interest income is usually taxed at a higher rate than dividends or capital gains, and often at progressively higher rates. As a result, tax-exempt bonds (such as munis in the United States) may form a large part of a taxable investor's fixed income allocation.
- Dividends are usually taxed at a lower rate than interest. Some investors may invest in preferred stocks in place of bonds for this reason.
- Capital gains are usually taxed at a lower rate than income, and capital losses can be used to offset capital gains elsewhere in the portfolio.
- Certain investment accounts may be tax deferred or tax exempt. The least tax-efficient (most heavily taxed) assets should be placed in the most tax-advantaged accounts.

Taxes complicate the portfolio optimization process. Return and risk need to be considered on both a pre- and after-tax basis, although correlations will be unaffected by taxes.

EXAMPLE: After-tax return

An investor subject to income tax on interest earned at a rate of 40% is considering investing in a bond with a 5% coupon that is expected to be held to maturity. What return should the investor use as an input into the asset allocation process?

Answer:

As the investor is taxable, the after-tax return of $0.05(1 - 0.4) = 0.03$ or 3% should be used.

Equity returns include both dividend income and capital gains. Therefore, the after-tax calculation must adjust for income tax and capital gains tax.

EXAMPLE: Multi-step after-tax return calculation

An investor is subject to income tax at a rate of 30% on dividend income and 20% on capital gains. One potential investment under consideration is a stock with an estimated pre-tax return of 16%. Ten percent of this return is expected be realized in the form of dividend income and 90% as price appreciation (capital gains are assumed to be realized annually). What is the after-tax return to be used in the asset allocation process?

Answer:

Pre-tax dividend income:	$16\% \times 0.1$	= 1.6%
After-tax dividend income:	$1.6\% (1 - 0.3)$	= 1.12%
Pre-tax capital gain:	$16\% \times 0.9$	= 14.4%
After-tax capital gain:	$14.4\% (1 - 0.2)$	= 11.52%
After-tax return:	$1.12 + 11.52$	= 12.64%

When an asset has a cost basis (for tax purposes) that differs from the market value, it has an existing unrealized gain (cost basis is below market value) or loss (cost basis is above market value). Unrealized gains imply an embedded tax liability and losses imply an embedded tax asset. There are three potential ways in which the current market value may be adjusted to reflect the liability or asset.

1. Subtract the value of the embedded capital gains tax from the current market value of the asset as if it were to be sold today.
2. Assume the asset is to be sold in the future and discount the tax liability to its present value using the asset's after-tax return as a discount rate.
3. Assume the asset is to be sold in the future and discount the tax liability to its present value using the after-tax risk-free rate.

Risk, as measured by standard deviation, must also be adjusted in the presence of tax. Capital gains tax reduces the gains realized on price appreciation, and the ability to use capital losses to offset those gains also reduces the losses realized from price

declines. A post-tax standard deviation should therefore be used as an input into the asset allocation process.

EXAMPLE: After-tax standard deviation of return

A security has an expected pre-tax standard deviation of 12% and is under consideration for purchase by an investor who suffers capital gains tax at a rate of 20%. What is the after-tax standard deviation?

Answer:

$$\text{after-tax standard deviation} = 12\%(1 - 0.2) = 9.6\%$$

The use of both after-tax returns and after-tax risk can have significant impacts on the efficient frontier. Notably, allocations to tax inefficient assets such as high yield bonds will usually decrease. Such assets can, however, still play a part in the optimal allocation assuming they have low correlations with other assets in the portfolio.

Portfolio Rebalancing

To maintain the strategic asset allocation, all portfolios must periodically rebalance. Taxable asset owners will realize taxable gains at each rebalancing, so they must balance the need to maintain the strategic asset allocation with the desire to avoid taxable gains through frequent rebalancing.

Rebalancing should occur less frequently in taxable portfolios due to the reduction in volatility caused by taxation (while correlations remain unaltered). The acceptable rebalancing range after-tax can be calculated by first finding the allowable deviation from target: after-tax deviation = pre-tax deviation / (1 - t).



PROFESSOR'S NOTE

Be careful not to confuse the impact of taxes on after-tax standard deviation (of return) with the impact of taxes on allowable after-tax deviation from target weight for an asset class.

- Taxes cushion the pretax upside and downside of an asset's return and therefore **decrease** after-tax standard deviation of the asset (compared to its pretax standard deviation).

$$\sigma_{AT} = \sigma_{PT} (1 - t)$$

- Because taxes lower return volatility, they **increase** the allowable deviation from target allocation weight (compared to pretax deviation).

$$\text{deviation from target weight}_{AT} = \text{deviation from target weight}_{PT} / (1 - t)$$

EXAMPLE: Pretax vs. after-tax deviation from target allocation weight

A tax-exempt investor's strategic asset allocation calls for a 40% investment in fixed income, $\pm 5\%$ for a range of 35–45%. If fixed income returns are subject to a

30% tax rate, **calculate** the equivalent after-tax rebalancing range.

Answer:

pretax allowable deviation from target weight = $45\% - 40\%$ (or $40\% - 35\%$)
= 5%

post-tax deviation from target weight = $5\% / (1 - 0.30) = 7.14\%$ for a range of
32.86–47.14%

There are two strategies that can be employed to reduce the impact of taxation:

- Tax loss harvesting.
- Strategic asset location.

Tax loss harvesting involves deliberately realizing losses to offset gains elsewhere. Strategic asset location involves making the most efficient use of tax advantageous accounts. There are two types of accounts that offer tax advantages:

- Tax exempt accounts: assets in these accounts are not subject to taxation.
- Tax deferred accounts: assets can appreciate in these accounts tax free but are taxed upon distribution.

Assets placed in tax-exempt accounts need no adjustment to their market value before being included in the asset allocation process. However, the value of assets in tax-deferred and taxable accounts should be reduced by the tax burden.

The portfolio optimization process should consider both the asset classes available and the asset location. For example, if an investor has two accounts available: one taxable and one tax deferred—and two potential asset classes: fixed income and equities, the process should use four account types. It should use two for each asset class, depending on whether they are placed in the taxable or tax-deferred accounts.

The risk and return inputs for equities and fixed income assets to be located in the tax-deferred vehicle (which are allowed to grow tax-free) should be pre-tax. Risk and return inputs for each asset class to be located in the taxable vehicle should be after-tax.

Although liquidity needs for consumption should always be considered (e.g., assets allocated to pension accounts may not be accessible without incurring financial penalties), the following general rules should be applied when considering asset location:

- Assets subject to the lowest tax rates (typically equity) should be first allocated to taxable accounts.
- Assets subject to frequent trading and high tax rates should be allocated to tax-advantaged accounts.



MODULE QUIZ 5.1

1. An extremely large fund seeking to make a large allocation to an asset class will *most likely* face a liquidity constraint when investing in:
A. hedge funds.
B. global equity.

- C. investment-grade bonds.
2. A fund manager oversees a tax-exempt fund and a taxable fund. The strategic asset allocation for both funds is 60% equity and 40% fixed income, with an after-tax rebalancing range of $\pm 12.5\%$, assuming a tax rate of 20%. The current allocation in both funds is 71% equity and 29% fixed income. Which of the following statements is *most accurate*?
- A. Only the tax-exempt fund is outside its applicable rebalancing range.
B. Both funds are outside their respective rebalancing ranges.
C. Neither fund is outside its applicable rebalancing range.

MODULE 5.2: ADJUSTING THE STRATEGIC ASSET ALLOCATION



Video covering this content is available online.

LOS 5.c: Recommend and justify revisions to an asset allocation given change(s) in investment objectives and/or constraints.

It is unlikely that the initial optimal asset allocation will be applicable for the entire lifetime of any portfolio. In practice, it is common to reevaluate the allocation annually or if a change in goals, constraints, or beliefs suggests it is required.

Change in Goals

For (some) institutions, the business cycle may trigger changes in goals.

A downturn in business, for example, may necessitate increased cash flows from the portfolio. For instance, as airlines face competition from low-budget competitors, and because of uncertain revenue streams, they may reduce the level or risk exposure in their pension fund in order to smooth the volatility of contributions. Pension funds themselves have faced increasing deficits in recent years, which also triggers a reexamination of the asset allocation.

Changes in personal circumstances for the individual investor will also impact the allocation decision. Changes in employment status or starting a family, could both impact an investor's willingness and ability to take on risk.

Change in Constraints

A change in any of the constraints discussed earlier in this reading would also necessitate a review of the current allocation. Examples include:

- Government regulations requiring increased distributions to maintain tax-exempt status.
- Large unexpected cash flows to cover one-off events.
- Increased funding requirements for the beneficiary of an endowment.
- Forced early retirement of an investor due to illness.

Any change in constraint that leads to a requirement for increased cash outflows is likely to necessitate a shift to more liquid assets. Conversely, a large inflow (such as a donation to a foundation) is likely to give the portfolio more flexibility to take on risk.

Change in Beliefs

The investment activities of the asset owner are guided by a set of principles, or beliefs. Just as with goals and constraints, there is no guarantee that these beliefs will not change over time.

For a portfolio run by an investment committee, for example, a change in the makeup of that committee could change beliefs. New members are typically walked through an asset allocation study to make sure they understand the investing approach that had been adopted.

Changes in the economic environment are also likely to have a major impact on the optimization process.

The key inputs when optimizing the asset allocation are expected returns, volatility, and correlation of assets. If macroeconomic forecasts for any major asset class change, then the optimal allocation will likely change. An allocation exercise undertaken in the interest rate environment pre-2008 would have very different expectations for fixed income performance than one undertaken post-2008.

Asset allocations may also change at predetermined dates without the need for a detailed reexamination. Target-date mutual funds, for example, adjust allocations for individual investors depending on their age. Such funds use a *glide-path* and shift from equity to more conservative investments (nominal and inflation-protected bonds) as the target date of the fund approaches.

LOS 5.d: Discuss the use of short-term shifts in asset allocation.

The long-term asset allocation specified in an investment policy statement is known as the *strategic asset allocation (SAA)*. This represents the target asset weightings for the portfolio.

Short-term deviations, known as *tactical asset allocations (TAAs)*, are typically used to take advantage of cyclical conditions in the market or a perceived mispricing in a given asset class.

Objective

The objective of TAA is to increase risk-adjusted returns by exploiting these short-term opportunities. It should be noted that this strategy assumes short-term returns are predictable (rather than a random walk as for long-term returns), and its success is dependent on market or factor timing, not individual security selection.

The TAA will still take into account the risk constraint specified in the investment policy statement, but will not consider specific goals or liabilities.

Constraints

The success of the TAA should be judged against the benchmark of the SAA. The size of deviations may often be limited to a range around this allocation. There may also be an allowable range of predicted volatility or a tracking error budget versus the SAA.

Evaluation

There are several common methods of measuring the success of a TAA decision.

- Comparing the Sharpe ratios under the TAAs and the SAAs.
- Calculating the information ratio or t-stat of the excess realized returns relative to the SAA.
- Comparing the realized risk and return of the TAA to portfolios lying on the SAA's efficient frontier. It may be less optimal than other portfolios on that frontier.
- Perform attribution analysis on the excess return to identify the contribution of specific under- or over-weightings.

Drawbacks

The use of TAA incurs additional trading costs and taxation in the case of taxable investors. Overweighting an asset class also concentrates risk within the portfolio and reduces diversification benefits.

Approaches to Tactical Asset Allocation

Discretionary TAA relies on qualitative interpretation of macroeconomic variables. A skillful manager will aim to enhance returns in a rising market and hedge risks in falling markets by successfully forecasting short-term deviations from expected returns for an asset class. A manager may use a combination of macroeconomic data, fundamental data, and sentiment indicators to assist with forecasting.

Macroeconomic data will focus on bond yields and credit spreads, monetary policy, GDP growth, earnings and inflation predictions, and other leading economic indicators. Fundamental data such as the deviation of P/E, P/B ratios and dividend yield from their historic means may also be used. Economic sentiment can be gauged using a consumer confidence index.

Market sentiment can be assessed using:

1. Margin borrowing: Increasing purchases on margin drives up prices and indicates investors are bullish, although if the level of margin buying gets too high, it can be a bearish sign and indicates investors are overenthusiastic.
2. Short interest (aggregate amount of short selling): This is essentially the opposite. Increasing short interest drives down prices and indicates investors are bearish, although very high levels could indicate the market is at or near a low.
3. Volatility indices: These indicate the level of fear in the market. It can be calculated using the bid-ask spread on index options. It increases with more purchases of puts and decreases with more purchase of calls.

Although the range of data used in discretionary TAA is quantitative in nature, the individual manager decides which indicators to use and how to prioritize and interpret them.

A systematic approach takes a more quantitative view. It attempts to capture excess returns using strategies that have historically been predictable and persistent. Two of the main factors that may be exploited are value and momentum.

A value approach aims to exploit the excess return of value stocks over growth stocks. Value in equities is most commonly measured using dividend or cash flow yields. Shiller's earnings yield (E/P) uses a 10-year average inflation-adjusted earnings figure compared to market price. Value currencies may be identified using short-term interest rate differentials, and commodities may be identified using roll yields. Commodity markets in backwardation will provide positive roll yields to the long, and those in contango negative. Yield spreads over risk free rates can be used to identify value in fixed income.

A momentum strategy assumes that trends will persist, which is why recent price movements are used to indicate whether to overweight or underweight an asset class. Indicators used include:

- Most recent 12-month trend: a momentum strategy assumes this trend will persist for the next 12 months.
- Moving-average crossover: shorter-term moving averages crossing above longer-term moving averages indicate an uptrend and vice versa.

MODULE 5.3: BEHAVIORAL ISSUES



Video covering this content is available online.

LOS 5.e: Identify behavioral biases that arise in asset allocation and recommend methods to overcome them.

Behavioral biases can cause problems during the asset allocation process. An awareness that behavioral bias exists is crucial to dealing with every bias.

Loss aversion is a bias in which investors dislike losses more than they like gains. This makes it difficult for investors to maintain discipline when returns are negative. There is a strong temptation to alter the asset allocation. Goals-based investing can help overcome the loss aversion bias. Goals are prioritized and subportfolios are used. High priority goals are funded with less risky assets, and riskier assets can be used in each subportfolio as the goal priority declines. Risk analysis typically focuses on downside measures such as shortfall risk.

Illusion of control is a tendency to overestimate the ability to control events. Combined with overconfidence, it typically leads to investors failing to diversify, trading too frequently, or both. Some common signs of this bias include:

- Frequent trading and tactical allocation shifts in an attempt at market timing. Investors who correctly call the reversal of a trend have too much confidence in their ability to repeat.
- Active security selection by institutional investors who believe the level of resources at their disposal gives them superior asset selection skills.
- Above average use of short selling and leverage.
- Shifting asset allocations despite a lack of consensus opinion as an individual trustee believes they know better than the market.
- Concentrated positions that expose the portfolio to diversifiable risk.

- Use of biased risk and return forecasts in the asset allocation framework that result in allocations that are inappropriately different from the market portfolio.

To counter the illusion of control, the market portfolio derived from the basic CAPM mean-variance framework should be used as the starting point for the allocation, and shifts in allocation away from this position should be subject to a formal review process.

Mental accounting involves separating assets and liabilities into different “buckets” based on **subjective criteria**. Mental accounting often leads to suboptimal asset allocations and less chance of meeting the goals. Individuals, for example, may spend their tax refund on luxury goods even when their savings are inadequate, or they may maintain low-interest savings accounts while paying high interest on large credit card balances. Entrepreneurs may form an emotional attachment to a company they founded and irrationally hold it in their high risk aspirational risk bucket, even when they no longer have any control at the company. Goals-based investing can help overcome mental accounting bias.



PROFESSOR'S NOTE

Notice that mental accounting is not the same thing as goals based even though goals-based investing has some elements of mental accounting in it. Goals-based investing is primarily a rational effort to differentiate the priority of goals and then use subportfolios in an effort to increase the chances of meeting the goals.

Representative bias, or *recency bias*, occurs when investors attach more importance to recent data than old data. The most common result is for an investor to shift allocations towards assets that have performed well recently. The popularity of purchasing and “flipping” (planning to sell it quickly at a profit) real estate property in the 1990s, can be traced back to a generation who had only experienced rising house prices. The problem was the past trend can and did change. Strong governance and objective asset allocation process are the best methods of defense against representative bias.

Framing bias occurs when the way information is presented affects the resulting decision. This is a common problem in asset allocation. If risk is presented as standard deviation, most investors prefer the lower risk. But downside risk measures may be more useful in specific situations. These include:

- VaR indicates amount of loss at some probability over a time.
- Conditional VaR quantifies the average loss within the VaR tail.
- Shortfall probability directly states the probability of some adverse outcome occurring.

The best way to overcome framing bias is to provide a full range of relevant information and not selectively frame only some pieces of the information.

Availability bias occurs when personally experienced or more easily recalled events disproportionately influence decisions. For example, an investor who suffered significant losses when the tech bubble burst won't buy tech or high P/B ratio stocks ever again. Investors make availability bias mistakes if they benchmark their

portfolio performance to that of other investors, without regard to whether those other investors have comparable goals and constraints.

- *Familiarity bias* may be considered an offshoot of availability in that what is familiar or easy to recall is given too much importance in the decision process.
- *Home bias* can be considered another offshoot and is often seen in portfolios that over allocate to domestic securities, missing the opportunity to diversify with international securities.

Starting the allocation process with the global market portfolio can help to mitigate availability biases in the asset allocation process.

Investment Governance

Effective governance is essential to keeping behavioral bias under control. An effective framework should incorporate:

- Clearly stated long-term and short-term objectives.
- Logical allocation of responsibility for asset allocation decisions based on skills and workload.
- Documented processes for developing and approving the investment policy statement.
- Documented process for developing and approving the strategic asset allocation.
- Framework to monitor and report performance relative to specified goals and objectives.
- Periodic audits.



MODULE QUIZ 5.2, 5.3

1. A target date mutual fund being used by an individual with a goal of retiring at age 65 will *most likely*:
 - A. increase the allocation to inflation-protected bonds later in the glide path.
 - B. have a larger allocation to nominal bonds earlier in the glide path as opposed to later.
 - C. allocate more of the portfolio to cash in the early phases of the glide path.
2. Which of the following statements regarding the relative success of a tactical asset allocation (TAA) against the strategic asset allocation (SAA) is *most likely* correct?
 - A. The TAA is successful if it has a positive Sharpe ratio.
 - B. The TAA is unsuccessful if the information ratio is negative.
 - C. The TAA is successful if it has a lower standard deviation than that of the SAA.
3. Ellie Rotheram is a 42-year-old real estate broker. Through patient saving, she has accumulated a retirement portfolio worth \$720,000. Her investment approach is very conservative, with 88% allocated to fixed income and 12% to equity. She does not want to take the higher risk of equity in this retirement portfolio. Recently, Rotheram inherited \$500,000 and placed this in a separate portfolio. She realizes she has been very conservative in her retirement portfolio and plans to invest this portfolio more aggressively, in an effort to improve her lifestyle. So far, she has invested \$225,000 in real estate investment trusts with holdings in her home state. She also invested \$50,000 in the equity of a property development company, because she used to work there several years ago.

Which of the following behavioral biases is Rotheram *most clearly* exhibiting?

 - A. Mental accounting.

- B. Familiarity bias.
- C. Framing bias.

KEY CONCEPTS

LOS 5.a

Portfolios that are too small may be unable to invest in alternative investment vehicles that have minimum investment or qualification requirements.

Large portfolios have the skill, governance structure, and capital resources to invest in complex strategies and achieve diversification levels that smaller portfolios may be unable to achieve.

Portfolios that are too large may find it difficult to invest in niche strategies as the asset pool or managers available are quickly exhausted.

The asset owner's liquidity needs should be matched to the liquidity characteristics of an asset when optimizing asset allocation.

Investor behavior often changes during periods of negative returns, so any liquidity analysis should include an evaluation of liquidity requirements in times of market stress.

Longer time horizons typically allow for greater risk exposure due to the time diversification of risk.

Changes in goals, liabilities, and human capital as time passes mean the asset allocation process is a dynamic one that must be regularly revisited.

LOS 5.b

Investors subject to regulatory and tax requirements must factor those constraints into the asset allocation process.

Taxation reduces the risk and return of assets but leaves asset correlations unaltered.

Lower after-tax risk levels lead to wider rebalancing ranges for taxable investors. Frequent rebalancing leads to realized taxable gains.

Assets taxed at higher effective rates should be allocated first to tax advantaged accounts.

LOS 5.c

Asset allocations should be reviewed in the light of changing goals, beliefs, or other constraints.

Asset allocations may change automatically along a predetermined glide path in reaction to milestones or predictable events that change an investor's risk ability and willingness to take risk.

LOS 5.d

Short-term alterations to the long-term strategic asset allocation are known as tactical asset allocations (TAAs). The permitted size of alterations is likely to be dictated by the investment policy statement.

TAAAs aim to enhance returns by altering asset classes, sectors, or risk-factor premium weightings.

The performance of TAAAs can be measured by comparing realized portfolio results with TAA implemented to what would have happened under strategic asset allocation (SAA). Success is indicated by a better Sharpe ratio, information ratio, or t-stat of the excess returns. Actual TAA results that plot on the efficient frontier also indicate success.

TAAAs can result in excessive trading and tax costs and in the concentration of risk in specific assets in the portfolio.

Systematic TAA uses quantitative signals to dictate shifts in weightings, whereas discretionary allocation relies on qualitative interpretation of data and manager skill in identifying shorter-term trends.

LOS 5.e

- Loss aversion occurs when a dislike of losses and preference for gains distorts rational decision making. Use goals-based investing to mitigate.
- Illusion of control is an overestimation of ability to control events. Start with the CAPM market portfolio and use sound corporate governance to mitigate.
- Mental accounting subjectively (not rationally) treats different pools of funds differently and often leads to suboptimal asset allocation. Use goals-based investing to mitigate.
- Representative (recency) bias overemphasizes the importance of the most recent events and can lead to trend following, assuming what is currently happening will continue. Use sound corporate governance to mitigate.
- Framing bias can result in suboptimal decisions when the way information is presented affects the decisions made. Start with a full range of relevant information to mitigate.
- Availability, familiarity, and home bias are closely related. What is easily recalled or available is given too much importance in the decision process. Start with the CAPM market portfolio to mitigate.

A strong governance process guards against most behavioral biases and should include clearly defined objectives (short and long term), responsibilities, and decision-making process along with a framework for monitoring, reviewing, and performing periodic internal audits.

ANSWER KEY FOR MODULE QUIZZES

Module Quiz 5.1

1. **A** Hedge funds are likely the smallest and least liquid class of the three choices. (LOS 5.a)
2. **A** The after-tax rebalancing deviation specified is 12.5% using a tax rate of 20%. The pretax deviation is therefore $12.5\% \times 0.8 = 10\%$. This means the tax-exempt portfolio is outside its applicable range. The range for the tax-exempt fund is 50% to 70% for equity and 30% to 50% for FI. The range for the taxable

fund is 47.5% to 72.5% for equity and 27.5% to 52.5% for FI. Note that the effect of taxes on allowable deviation from target allocation weight was directly covered in our write up.

$$\text{deviation from target weight}_{AT} = \text{deviation from target weight}_{PT} / (1 - t)$$

In this case, you must work from deviation AT backwards to deviation PT, so the relationship is:

$$\text{deviation from target weight}_{AT} (1 - t) = \text{deviation from target weight}_{PT}$$

(LOS 5.b)

Module Quiz 5.2, 5.3

1. **A** Target date funds are intended for individuals who plan to retire on the fund's target date. The glide path ends on the target date. As the fund moves from early to late on the glide path, the asset allocation is shifted from equity towards more fixed income and cash. (Module 5.2, LOS 5.e)
2. **B** None of these are perfect answers in that we'd like to know how return to risk for the fund after TAA compares to what would have happened if the SAA (no TAA) had been followed. A negative IR certainly indicates failure as the goal of TAA is positive value added (the numerator of the IR ratio should be positive not negative). A positive Sharpe ratio alone says nothing about how SAA would have done, and lower risk with no idea of return earned provides little information. (Module 5.2, LOS 5.d)
3. **B** She exhibits familiarity bias when investing in equity of a company because she used to work there and a REIT because it has holdings in her home state. She is also using goals-based investing and while that has elements of mental accounting in it, the motivations are quite different. Using subportfolios to address different priority goals can be quite rational and is not by itself a bias. There is no indication that framing of information is a factor here. (Module 5.3, LOS 5.e)

TOPIC QUIZ: ASSET ALLOCATION

You have now finished the Asset Allocation topic section. On your Schweser online dashboard, you can find a Topic Quiz that will provide immediate feedback on how effective your study of this material has been. The test is best taken timed; allow three minutes per question. Topic Quizzes are more exam-like than typical QBank questions or module quiz questions. A score less than 70% suggests that additional review of the topic is needed.

FORMULAS

Target interest rate using the neutral rate:

$$r_{\text{target}} = r_{\text{neutral}} + i_{\text{expected}} + [0.5(\text{GDP}_{\text{expected}} - \text{GDP}_{\text{trend}}) + 0.5(i_{\text{expected}} - i_{\text{target}})]$$

Grinold-Kroner model:

$$E(R_e) \approx D/P + (\% \Delta E - \% \Delta S) + \% \Delta P/E$$

Singer-Terhaar model:

risk premium assuming full integration:

$$RP_i = \rho_{i,M} \sigma_i (\text{market Sharpe ratio})$$

risk premium assuming full segmentation:

$$RP_i = \sigma_i (\text{market Sharpe ratio})$$

weighted average risk premium:

$$RP_i = (\text{degree of integration of } i)(\text{ERP assuming full integration}) + (\text{degree of segmentation of } i)(\text{ERP assuming full segmentation})$$

Capitalization rate (with infinite time period):

$$\text{cap rate} = E(R_{re}) - \text{NOI growth rate}$$

$$E(R_{re}) = \text{cap rate} + \text{NOI growth rate}$$

Capitalization rate (with finite time period):

$$E(R_{re}) = \text{cap rate} + \text{NOI growth rate} - \% \Delta \text{cap rate}$$

Expected percentage change in the exchange rate:

$$E(\% \Delta S_{d/f}) = (r^d - r^f) + (\text{Term}^d - \text{Term}^f) + (\text{Credit}^d - \text{Credit}^f) + (\text{Equity}^d - \text{Equity}^f) + (\text{Liquid}^d - \text{Liquid}^f)$$

Return of the i th asset in a multifactor model:

$$r_i = \alpha_i + \sum_{k=1}^K \beta_{ik} F_k + \varepsilon_i$$

Variance of the i th asset:

$$\sigma_i^2 = \sum_{m=1}^K \sum_{n=1}^K \beta_{im} \beta_{in} \rho_{mn} + \nu_i^2$$

Covariance between the i th and j th asset:

$$\sigma_{ij} = \sum_{m=1}^K \sum_{n=1}^K \beta_{im} \beta_{jn} \rho_{mn}$$

Smoothed returns to estimate volatility is the weighted average of the current “true” returns and previously observed returns:

$$R_t = (1 - \lambda)r_1 + \lambda R_{t-1} \text{ where } \lambda \text{ is a weight between 0 and 1}$$

$$\text{Portfolio variance} = \text{var}(r) = \left(\frac{1 + \lambda}{1 - \lambda} \right) \text{var}(R) > \text{var}(R)$$

ARCH model:

$$\sigma_t^2 = \gamma + \alpha \sigma_{t-1}^2 + \beta \eta_t^2 = \gamma + (\alpha + \beta) \sigma_{t-1}^2 + \beta (\eta_t^2 - \sigma_{t-1}^2)$$

where α , β , and γ are nonnegative parameters and $(\alpha + \beta) < 1$, and η_t is a random variable indicating the unexpected return component.

Higher $\alpha + \beta$ terms indicate higher emphasis on past information, leading to volatility clustering.

$$U_m = E(R_{s,m}) - 0.005 \times \lambda \times \text{Var}_{s,m}$$

where:

$E(R_{s,m})$ = expected surplus return

$\text{Var}_{s,m}$ = variance of surplus return

After-tax *standard deviation* = pretax standard deviation $(1 - t)$

After-tax *deviation from midpoint of target asset allocation* = pretax deviation / $(1 - t)$

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