Insurer Investment Portfolio Management

**Quantitative Measures of Risk**

An important consideration in evaluating the potential return on an investment is the likelihood that the actual return will exceed or fall short of expectations. There are several quantitative ways to measure the risk, or variability, of an asset’s price or rate of return.

There are several quantitative measures of risk:

* Variance
* Standard deviation
* Coefficient of variation
* Value at risk
* Beta

These measures deal with variation from expected value, amount of loss that is possible, and risk relative to the market.

**Variability of Rates of Return**

In choosing among various investments, the first consideration is usually the expected rate of return. However, the variability of the investment return, the likelihood that the actual return will be higher or lower than expected – is also an important factor in evaluating investments.

For example, assume that assets A and B each have a compound annual average return of 10%. However, the individual years’ returns for Asset B have varied from that average more than the returns on Asset A. Several risk metrics are available to measure the variability of the expected average rate of return. The most frequently used risk metrics are variance, standard deviation, coefficient of variation, value at risk, and beta.

**Variance**

**Variance – A measure of dispersion; a measure of the deviation of each variable in a data set from the mean of the data set**.

**In financial management, variance quantifies investment risk by measuring the deviation of an investment’s returns from the average return of the investment during a specific period. The size of the investment’s variance indicates how much the actual returns could differ from the average.**

Variance = Sum of squared ÷ (n – 1) (n= number of elements in the data set)

Example Squared difference .40 over 4 years .40 ÷ 4 + 0.010

The difference between the average and each actual value is squared in order to produce an increased penalty when the difference is large.

A similar calculation for Asset B yields a variance of 0.132, which is substantially higher.

The units of variance are percentage rates of returned squared, while the original units of value are simple percentage rates of return. This difference in units can make it difficult to interpret the results of variance calculations. Therefore, it is useful to convert the variance units back to the data set units by taking the square root of the answer.

**Standard Deviation**

**Standard deviation – A measure of dispersion between the values in a distribution and the expected value (or mean) of that distribution, calculated by taking the square roof of the variance**.

The standard deviation is another measure of differences (deviations) between the values in a set and the expected value (or mean) of that set. It is the square root of the variance of the data. For example, the standard deviation of the annual rates of return in the prior example is the square root of 0.010, which equals 0.100 and the second example the standard deviation is the square roof of 0.132, or 0.363

As is true for the variance, a low standard deviation indicates the data points are usually very close to the mean (expected value), whereas a high standard deviation indicates that the data points are usually spread out.

**The standard deviation has several characteristics that make it one of the most common ways to measure risk:**

* **It is fairly simple to calculate**
* **It is express in the same units as the data set**
* **It can be used with statistical distributions to estimate the likelihood of various levels of return.**

**Coefficient of Variation**

**Coefficient of variation – A measure of dispersion calculated by dividing a distribution’s standard deviation by its mean (expected value).**

Specifying the standard deviation is not useful without also specifying the mean. A standard deviation of 10% is significant if the expected mean return is 12%, but is less of an issue if the expected return is 40%

The comparison of variability is simplified if the standard deviation of different data sets are compared to their respective means. The coefficient of variation is a distribution’s standard deviated by its mean or expected value. The variation of actual values can then be compared no matter the data sets’ differences in magnitude or units of measure.

For example, suppose that there is an asset with a price of $50 with a standard deviation of $20 from that price. If the stock splits so that there are now two shared for every one before, the new shares will have an average price of $25 and a standard deviation of $10. While the standard deviation is lower after the split, that does not mean that the new shares have less risk (variability) than the old ones. The coefficient of variation is the same 0.4 (which equals both $20 ÷ $50, and $10 ÷ $25) before and after. So, the coefficient of variation accurately reflects the variability relative to the mean.

**(Standard deviation/ Mean return) = Coefficient of variation**

Measures such as standard deviation and coefficient of variation do not give an indication of the dollar amount involved in the risk being assessed. Therefore, financial managers will also want to consider the value at risk.

**Value at Risk**

**Value at risk – a threshold value that the probability of loss on the portfolio over the given time horizon exceeds this value, assuming normal markets and no trading in the portfolio.**

Value at risk (VaR) is defined as a threshold value such that the probability of loss on the portfolio over the given time horizon exceeds this value (assuming normal markets**). The value at risk is based on two selected inputs:**

* **The probability of loss**
* **The time horizon during which the loss can occur**

VaR provides decision makers with three key benefits:

* The potential loss associated with a decision can be quantified
* Complex positions are expressed as a single amount
* Loss is expressed in monetary terms that are easily understood.

However, VaR is limited in that it does not accurately measure the extent to which a loss might exceed the VaR threshold. For example, the $300K VaR in the example does not reflect whether the loss might be $1M or even as much as $10M

**Beta**

**Beta – a measure of an asset’s volatility relative to that of the overall market for that type of asset.**

Most of the previous quantitative measure of variability describes the risk compared to an expected rate of return. An asset’s beta coefficient, more commonly called its beta, describes the variability in the price of an asset relative to the variability of an average asset. Beta reflects the extent to which a change in the overall marketplace can affect a particular asset. For example, a stock with a beta of 0.50 I only half as volatile as the overall stock market. **A beta above 1.0 indicate greater than average volatility**.

**Investment Portfolio Management Concepts**

Investing is more complex than avoiding “putting all your eggs in one basket.” The goal of an investment portfolio, which is to provide the highest possible return at an acceptable level of risk, requires consideration of a number of factors.

**The Risk-Return Trade-off**

**Risk-return trade-off – the tendency for the potential return to increase as risk increases.**

Given a choice between investing in a government bond that guarantees 5% interest or a common stock that is expected to return 5%, most investors would chose to invest in the government security because doing so involves a lower level of risk.

Much of economic and financial theory depends on the assumption that investors and managers are risk averse.

**A risk-averse decision maker will therefore demand a higher rate of return from an investment that has a higher risk. This is known as the risk-return trade-off, and it requires investors to determine the appropriate balance between assuming the lowest possible risk and achieving the highest possible returns.**

**Diversification**

**Market risk – Uncertainty about an investment’s future value because of potential changes in the market for that type of investment**

**Company-specific risk, or unsystematic risk – Risk that affects a specific company or a small group of companies.**

The investment risk of an asset can be broadly divided into two types

* Market risk, or systematic risk
* Company-specific risk, or unsystematic risk

Market risk occurs because the prices of individual securities tend to follow (or are correlated with) broad market swings independent of an individual company’s performance. For example, an unexpected rise in inflation will increase costs for all companies, regardless of how well any individual company manages its costs. An example of a company-specific risk is the loss of a company’s largest manufacturing facility as a result of a fire. This event affects only that one company.

**Diversification – A risk control technique that spreads loss exposures over numerous projects, products, markets, or regions**

Diversification reduces the investor’s exposure to unfavorable events that affect only a single investment by adding other investments to the portfolio. While stock was the specific investment example used earlier, investments can include assets such as cash, bonds, real estate, or commodities.

**A major difference between the two types of investment risk is that while company-specific risk can be eliminated with diversification, market risk cannot.** For example, by holding stocks in a large number of different companies, the company-specific risk associated with an individual company should not have a significant effect on the portfolio. However, market risk will remain and the investor’s portfolio will have approximately the same variability as the market.

**Benefits of Diversification**

When two or more assets are combined to form an investment portfolio, the expected return of the portfolio is equal to the weighted-average returns of the individual securities. However, the same is not necessarily true of the portfolio’s standard deviation, or risk**. The standard deviation of a portfolio will be less than the weighted average of the standard deviation of the individual securities because the returns of the securities held in the portfolio typically do not move in unison.**

According to the concept of risk-return trade-off, if two stocks have the same amount of risk (measured by standard deviation), the return should be the same.

The company could invest all of the $1M in either security and expect to earn 10%. If the company instead chose to split its investment, putting $500K in each stock the expected return would still be 10%. However, the risk of the portfolio, as measured by the standard deviation, is substantially less than the risk associated with investment in either of the stocks individually.

**Diversification can also enable an investor to achieve a higher rate of return for a given level of risk than would have been possible with a single asset**.

**Correlation of Portfolio Components**

In the example involving the two companies, the returns from the two companies differ each year. In statistics, the degree to which any two variables tend to move together is measured by their correlation coefficient, which ranges from +1 to -1. For example, two securities would have a correlation coefficient of +1 (perfectly positively correlated) if their price changes always moved in the same direction, and -1 (perfectly negatively correlated) if their price changes always moved in the opposite directions. If their price movements are totally unrelated, they would be referred to as uncorrelated, and the correlation coefficient would be zero.

However, it is not necessary to have a negative correlation in order to reduce risk by combining assets. The only requirement is that the returns of the new security not be perfectly positively correlated with the returns of the existing portfolio. Therefore, this portfolio’s risk could be reduced even further by adding a third security, even if its returns tend to move in the same direction. However, because market risk will always remain, there is a limit to how much risk can be reduced by continuing to add securities to the portfolio.

**Modern Portfolio Theory (MPT)**

Efficient frontier- the collection of securities portfolio combinations that generate the highest expected return for a given level of risk or that have the lowest risk for a given expected return.

When finance professionals make decisions regarding an investment, they employ a portfolio approach, commonly referred to as Modern Portfolio Theory (MPT**). MPT states that investors, through diversification can optimize their overall risk and return by carefully considering how the risks and returns of the various available investments interact. Since there is an optimum (best) mix, MPT states that there is a limit to the benefit of diversification,**

A portfolios risk and return can be plotted on a graph that shows it in relation to an “efficient frontier”, which is a line representing the set of available investment portfolios for which risk and return are optimized. MPT states that portfolios that reach the efficient frontier are optimized because they provide the maximum expected return for a given level of portfolio risk while having the minimum portfolio risk for a given expected return. Once the efficient frontier is reached, no new risk sources can make the portfolio more efficient.

**Bond Portfolio Management**

Bond portfolio management is particularly important for property-casualty insurers because investments in bonds typically account for more than 55 to 60% of the industry’s admitted assets.

Unlike equity investments in common or preferred stocks, bonds have a fixed maturity date-a specified time when the insurer must repay the principal (face) amount of the bond. Although the payment of cash dividends on stocks is at the discretion of the company’s board of director, interest payments on debt are a contractual obligation that must be met according to a predetermined schedule. These two characteristics of debt securities, a fixed maturity date and a fixed interest payment schedule, are particularly valuable to insurers, which must ensure that adequate funds are available when needed to pay for losses.

**The most important objective of portfolio management in general, and bond portfolio management in particular, is to structure the portfolio so that the amount and timing of investment cash inflows correspond to the firm’s expected cash outflows. For property-casualty insurers, the amount and timing of expected cash outflows are largely determined by the composition of the underwriting portfolio.** Property losses tend to be settled quickly, with most loss payments being made within two years. Consequently, relatively short term investments are needed to ensure that adequate funds are available to pay losses when due. In contrast, some liability losses may be outstanding many years before they are fully settled. This extended payment period suggests that at least a portion of the insurer’s assets should be invested in longer term investments that have the potential to generate higher returns.

**Investing in bonds exposes investors to some additional sources of risk. One source of risk is credit risk, the uncertainty about an issuer’s ability to make the required principal and interest payments as they come due**. As learned earlier obligations backed by US Government are considered to have no default risk and commonly referred to as “risk free”. However, all debt issued by corporations have an element of default risk, albeit relatively low for well established companies. As this risk specific to an individual debtor, it can be minimized by diversifying the bond portfolio over a large number of issuers.

**A second source of risk is interest rate risk. Interest rate risk refers to uncertainty about an asset’s value associated with changes in market-determined rates**. Interest rate risk cannot be eliminated through diversification because changes in the level of interest rates affect the prices of all debt.

**Cash Matching and interest Rate Risk**

**Cash matching provides a means of eliminating interest rate risk. An insurer only needs to hold the investment until it matures. Changes in interest rates will not matter because the insurer will not want to sell the investment in the market before it matures.**

**First, it works only when the insurer can purchase zero-coupon bonds with maturity dates and maturity values that precisely match the expected cash outflows from the underwriting portfolio. Second, even if such bonds are available, the insurer must be able to purchase enough of each type of security to match its expected claim payments. In practice, neither condition can be expected to be met, especially for insurers with very large underwriting portfolios**.

**Matching Investment and Liability Duration**

When purchasing bonds that pay interest on a predetermined schedule (as opposed to zero coupon bonds), an insurer must consider what to do with the interest payments as they are received, assuming they will not immediately be used to pay losses. If interest payments are going to be reinvested, the insurer is now exposed to a second type of interest related risk called reinvestment risk.

Reinvestment risk is the uncertainty about the rate at which periodic interest payments can be reinvested over the life of an investment. To illustrate, consider an investor who purchases a $1,000 ten-year bond that pays 6% interest at the end of each year. If those interest payments can be invested to yearn 6% in, for example a savings account, the balance in the saving account would be about $791 when the bond matures. If, however, market interest rates fell to 4% just after the bond was purchased, then the savings account would grow to just $724.

The insured must not be concerned only about the interest rates available at the time the original invest is made, but also about the prevailing interest rates when each interest payment is received. Techniques have been developed to help portfolio managers control interest rate risk. Although the maturity date of an investment gives some indication of its sensitivity to changes in interest rates, duration is generally accepted as a better measure. In the context of bonds, duration is a measure of the number of years required to recover the true cost of a bond, considering the present value of all coupon and principal payments to be received in the near future.

**There are two important characteristics of bond duration; the duration of a zero-coupon bond is always equal to its time to maturity**, and **the duration of a bond that pays interest over its life will always be less than its time to maturity.** Duration gives investment managers a way to compare bonds with different maturities and coupons.

Knowing the duration of the underwriting portfolio allows a bond portfolio manager either to invest in one or more securities that have the same duration as the underwriting portfolio or to combine several securities with different durations into a portfolio that has, in the aggregate, the same duration as the underwriting portfolio. **When the durations of the underwriting and investment portfolio are matched, the portfolio is said to be immunized against changes in interest rates**.

Portfolio immunization works because it balances the change in a bond’s price (the price effect) against the change in earnings obtained from reinvesting interest payments (the reinvestment effect). When interest rates decline, interest payments must be reinvested at a lower-than-expected rate, but the reduction in interest rates also causes the market value of the bond to increase.

If the duration of the investment and the liability are the same, the insurer will likely have enough cash available to settle its obligations regardless of any change in interest rates. If the duration of the investment portfolio is longer than the duration of the liability, the price effect will outweigh the effect of reinvesting the interest payments at a rate higher or lower than expected. Conversely, if the duration of the investment portfolio is shorter than the duration of the liability, the reinvestment effect will outweigh the price effect that results from a change in the interest rates.

Matching the duration of the bond portfolio and the underwriting portfolio is an ongoing requirement. On the investment side, **a change in interest rates affects the duration of the portfolio**. Theoretically, the composition of the bond portfolio should be changed every time interest rates change in order to keep the duration of the bond and underwriting portfolios properly matched.

On the liability side, changes in the insurer’s mix of business also indicate a need to rebalance the bond portfolio. For example, an increased emphasis on underwriting liability lines, which have a longer period between the occurrence of a claim and the settlement of the claim, will increase the duration of the underwriting portfolio.

Both underwriting risk and reserve estimation risk make the process of managing the bond portfolio even more complex because they create uncertainty as to what the target duration of the bond portfolio should be.

**Statutory Investment Restrictions**

All states regulate insurer investments. This regulation helps to ensure insurer solvency and liquidity so that, ultimately, all policyholder claims can be paid. State regulation effectively mandates that insurers hold investment portfolios that are prudent (some would even say quite conservative) and well diversified.

In keeping with their conservative and consistent approach to protecting insurer insolvency, regulators are the primary source of constraints imposed on insurer investment practices. These constraints take two main forms: asset restrictions and investment limitations.

*Insurers are permitted to show only certain assets on their balance sheets and are limited in the type of investment they can hold*. To achieve diversification in insurer investment portfolios, regulators also restrict how much an insurer can hold in any single investment.

**Asset Restrictions**

**While insurers can invest in a wide variety of assets, only certain assets are permitted to be included on an insurer’s balance sheet. Any other investment by an insurer must be assigned a zero value on the insurer’s balance sheet, a more than sufficient incentive to avoid large investments in nonadmitted assets**.

**Generally, permitted investments for insurers include money market instruments; high-quality investments that mature in less than one year, such as US Treasury bills and commercial paper; bonds of investment grade or better (issued by the US Treasury, state governments, certain municipalities, or credit-worthy private corporations; common stock; preferred stock; real estate loans (mortgages); and real estate**.

In many states, insurers must invest an amount equal to their required capital (or required capital plus certain other reserves) in an even narrower list of permitted investments.

**Investment Restrictions**

An insurer’s investment strategy can be stated as seeking to earn the highest possible return for a given level of risk or, alternatively, to minimize the risk associated with earning a given expected return. Compared to undiversified portfolios (or insufficiently diversified portfolios), properly diversified portfolios can be expected to produce consistently higher returns for a given level of risk or lower risk for a given level of return. The mechanics of designing a properly diversified portfolio are beyond the description of this text, but such a portfolio requires dozens of different investments.

**The primary goal of state regulation of insurer investments are to ensure liquidity and to ensure solvency for the sake of policyholders**. Three investment restrictions help ensure that insurers have well diversified portfolios that support the goals of liquidity and solvency.

* **Insurers can invest only up to a certain percentage of their assets in many of the permitted investments.**
* **Insurers are typically restricted in how much of their assets can be invested in any single investment.**
* **Insurers are restricted in the percentage of another company’s securities they can own**.

The overall effect of the investment restrictions on insurers is to encourage predominant investment in high-quality bonds. Investment in bonds helps enable insurers to meet their cash needs to satisfy the policyholder claims.