MODUL THEORY PORTFOLIO AND INVESTMENT ANALYSIS

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PORTFOLIO’S RISKS AND RETURN

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**Portfolio’s Risks and Returns**

The term investing can cover a wide range of activities. Such as investing money in certificates of deposit, bonds, common stocks, or mutual funds. An investment can be defined as the commitment of funds to one or more assets that will be held over some future time period. The field of investments, therefore, involves the study of the investment process. Investment is concerned with the management of an investor’s wealth, which is the sum of current income and the present value of all future income.

We study investments in the hope of earning better returns in relation to the risk we assume when we invest. A study of investment analysis and portfolio management principle can provide a sound framework for both managing and increasing wealth.

Common stocks have produced, on average, significantly larger returns over the years than savings accounts or bonds. Should not all investors invest in common stocks and realize these larger returns? The answer to this question is to pursue higher returns investors must assume larger risks. Underlying all investment decision is the trade-off between expected return and risk. Therefore, we first consider these two basic parameters that are of critical importance to all investors and the trade-off that exists between expected return and risk.

**The Basis of Investment Decision**

1. **Return**

Investors wish to earn a return on their money. Cash has an opportunity cost: by holding cash, you forego the opportunity to earn a return on that cash. Furthermore, in an inflationary environment, the purchasing power of cash diminishes, with high rates of inflation bringing a relatively rapid decline in purchasing power.

There are two categories of returns, namely;

- Expected Return: The ex ante return expected by investors over some future holding period

- Realized Return: Actual return on an investment for some previous period of time.

In investment it is critical to distinguish between an expected return (the anticipated return for some future period) and the realized return (the actual return over some past period). Investors invest for the future, for the return they expect to earn but when the investing period is over, they are left with their realized returns. What investors actually earn from their holdings may turn out to be more or less than what they expected to earn when they initiated the investment. This point is the essence of the investment process: Investors must always consider the risk involved in investing.

1. **Risk**

Investors would like their returns to be as large as possible; however this objective is subject to constraint, primarily risk. There are different types and therefore different definitions of risk. Risk is defined here as the chance that the actual return on an investment will be different from its expected return. It is easy to say that investors dislike risk, but more precisely, we should say that investors are risk averse. A **risk-averse investor** is one who will not assume risk simply for its own sake and will not incur any given level of risk unless there is an expectation of adequate compensation for having done so. Note carefully that it is not irrational to assume risk, even very large risk, as long as we expect to be compensated for it. In fact, investor cannot reasonably expect to earn larger return without assuming larger risk. **Risk-Free Rate of Return** is the return on a riskless asset, often proxied by the rate of return on Treasury securities.

**Structuring the Decision Process**

1. **Security Analysis**

The first part of investment decision process involves the valuation and analysis of individual securities, which is referred to as **security analysis**. Professional security analysts are usually employed by institutional investors. Of course, there are also millions of amateur security analysts in the form of individual investors. The valuation of securities is a time-consuming and difficult job. First of all, it is necessary to understand the characteristics of the various securities and the factors that affect them. Second, a valuation model is applied to these securities to estimate their price, or value. Value is a function of the expected future returns on a security and the risk attached. Both of these parameters must be estimated and then brought together in a model.

1. **Portfolio Management**

The second step in the investment decision process, involving the management of a group of assets as a unit. After securities have been evaluated, a portfolio should be selected. Concepts on why and how to build a portfolio are well known. Much of the work in this area is study of investments in this country in the last 30 years.

**THE RETURNS AND RISKS FROM IMVESTING**

Investors must have a good understanding of the returns and risk that have been experienced to date before attempting to estimate returns and risk, which they must do as they build and hold portfolios for the future.

**The Components of Return**

Return on atypical investment consists of two components:

* **Yield:** The basic component that usually comes to mind when discussing investing returns in the periodic cash flow (or income) on the investment, either interest or dividends. The distinguishing feature of this payments is that the issuer makes the payments in cash to the holder of the asset. **Yield** measures relate these cash flow to a price for the security, such as the purchase price or the current market price.
* **Capital gain (loss):** The second component is also important, particularly for common stocks but also for long-term bonds and other fixed-income securities. This component is the appreciation (or depreciation) in the price of the asset, commonly called the **capital gain (loss)**. We will refer to it simply as the price change. In the case of a long position, it is the difference between the purchase price and the price at which the asset can be, or is, sold; for a short position, it is the difference between the sale price and the subsequent price at which the short position is closed out. In either case, a gain or loss can occur. Given the two component of security’s return, we need to add them together (algebraically) to form the total return, which for any security is defined as:

Total return = Yield + Price change

 Where

 the yield component can be 0 or +

 the price change component can be 0, +, or –

This equation is a conceptual statement for the total return for any security. The important point here is that a security’s return consist of the sum of two components, yield and price change. Investors’ return from assets can come only from these two components—an income component (the yield) and/or a price change component, regardless of the asset.

**Sources of Risk**

What makes a financial asset risky? Traditionally, investors have talked about several sources of total risk, such as interest rate risk and market risk, which are explained below because these terms are used so widely.

* **Interest Rate Risk**

 The variability in a security’s return resulting from changes in the level of interest rates is referred to as **interest rate risk**. Such changes generally affect securities inversely; that is, other things being equal, security prices move inversely to interest rates. Interest rate risk affects bonds more directly than common stocks, but it affects both and is very important consideration for most investors.

* **Market Risk**

 The variability in returns resulting from fluctuations in the overall market—that is, the aggregate stock market—is referred to as **market risk**. All securities are exposed to market risk, although it affects primarily common stocks. Market risk includes a wide range of factors exogenous to securities themselves, including recessions, wars, structural change in economy, and changes in consumer preferences.

* **Inflation Risk**

 A factor affecting all securities is purchasing power risk, or the chance that the purchasing power of invested dollars will decline. With uncertain inflation, the real (inflation-adjusted) return involves risk even if the nominal return is safe (e.g., a Treasury bond) this risk is related to interest rate risk, since interest rates generally rise as inflation increases, because lenders demand additional inflation premiums to compensate for the loss of purchasing power.

* **Business Risk**

 The risk of doing business in a particular industry or environment is called **business risk**. For example, AT&T, the traditional telephone powerhouse, face major changes today in rapidly changing telecommunications industry.

* **Financial Risk**

 Financial risk is associated with the use of debt financing by companies. The larger the proportion of assets financed by debt (as opposed to equity), the larger the variability in the returns, other things being equal. Financial risk involves the concept of financial leverage, explained in managerial finance courses.

* **Liquidity Risk**

 Liquidity risk is the risk associated with particular secondary market in which a security trades. An investment that can be bought or sold quickly and without significant price concession is considered liquid. The more uncertainty about the time element and the price concession, the greater the liquidity risk. A Treasury bill has little or no liquidity risk, whereas a small OTC stock may have substantial liquidity risk.

* **Exchange Rate Risk**

 All investors who invest internationally in today’s increasingly global investment arena face the prospect of uncertainty in returns after they convert the foreign gains back to their own currency. Unlike the past when most U.S. investors ignored international investing alternatives, investors today must recognize and understand **exchange rate risk**, which can be defined as the variability in returns on securities caused by currency fluctuations. Exchange rate risk is sometimes called *currency risk*.

* **Country Risk**

 Also referred to as political risk, is an important risk for investors today. With more investors investing internationally, both directly and indirectly, the political, and therefore economic, stability and viability of a country’s economy need to be considered. The U.S. has the lowest country risk, and other countries can be judged on a relative basis using the U.S. as a benchmark. Examples of countries that needed careful monitoring in the 1990s because of country risk included the former Soviet Union and Yugoslavia, China, Hong Kong, and South Africa.

**Types of Risk**

Thus far, our discussion has concerned the total risk of an asset, which is one important consideration in investment analysis. However, modern investment analysis categorizes the traditional sources of risk identified previously as causing variability in returns into teo general types: those that are pervasive in nature, such as market risk or interest rate risk, and those that are specific to a particular security issue, such as business or financial risk. Therefore, we must consider these two categories of total risk. Dividing total risk into its two components, a general (market) component and a specific (issuer) component, we have systematic risk and nonsystematic risk, which are additive:

 Total risk = General risk + Specific risk

 = Market risk + Issuer risk

 = Systematic risk + Nonsystematic risk

1. **Systematic Risk**

As shown in later chapter, an investor can construct a diversified portfolio and eliminate part of the total risk, the diversifiable or nonmarket part. What is left is the nondiversifiable portion or the market risk. Variability in a security’s total returns that is directly associated with overall movements in the general market or economy or risk attributable to broad macro factors affecting all securities is called **systematic (market) risk**. Virtually all securities have some systematic risk, whether bonds or stocks, because systematic risk directly encompasses interest rate, market, and inflation risk. The investor cannot escape this part of the risk because no matter how well he or she diversifies, the risk of the overall market cannot be avoided. If the stock market declines sharply, most stocks will be adversely affected; if it rises strongly, as in the last few months of 1982, most stocks will appreciate in value. These movements occur regardless of what any single investor does. Ckearly, market risk is critical to all investors.

1. **Nonsystematic Risk**

The variability in a security’s total return not related to overall market variability or risk attributable to factors unique to a security is called the **nonsystematic (nonmarket)** **risk**. This risk is unique to a particular security and is associated with such factors as business and financial risk as well as liquidity risk. Although all securities tend to have some nonsystematic risk, it is generally connected with common stocks.

**MEASURING RETURNS**

1. **Total Return**

Total return is percentage measure relating all cash flows on a security for a given time period to its purchase price. A correct returns measure must incorporate the two components of return, yield and price change, as discussed earlier. Returns across time or from different securities can be measured and compared using the total return concept. Formally, the **total return (TR)** for a given holding period is a decimal (or percentage) number relating all the cash flows received by an investor during an designated time period t the purchase price of the asset. Total return is defined as

$$TR= \frac{Any cash payments recived+Price change over the period}{Price at which the asset is purchase}$$

All items in the equation are measured in dollars. The dollar price change over the period, defined as the different between the beginning (or purchase) price and the ending (or sale) price, can be either positive (sales price exceeds purchase price), negative (purchase price exceeds sales price) or zero. The cash payments can be either positive or zero. Netting the two items in the numerator together and dividing by the purchase price results in a decimal return figure that can easily be converted into percentage form. Note that in using the TR, the two components of return, yield and price change, have been measured.

$$TR= \frac{CFt+(PE-PB)}{PB}= \frac{CFt+PC)}{PB}$$

Where

 CF*t* = cash flows during the measurement period *t*

 P*E* = price at the end of period *t* or sale price

 P*B* = purchase price of the asset or price at the beginning of the period

 PC = change in price during the period, or P*E* minus P*B*

The cash flow for a bond comes from the interest payments received, and that for a stock comes from the dividends received. For some assets, such as a warrant or a stock that pays no dividends, there is only a price change. In summary, the total return concept is valuable as a measure of return because it is all-inclusive, measuring the total return per dollar of original investment. It facilitates the comparison of asset return over a specified period, whether the comparison is of different assets, such as stock versus bonds, or different securities within the same type, such as several common stocks. Remember that using this concept does not mean that the securities have to be sold and the gains or losses actually realized—that is, the calculation applies to unrealized gains, or realized gains.

1. **Return Relative**

Return relative is the total return for an investment for a given time period stated on the basis of 1.0. It is often necessary to measure returns on a slightly different basis than total returns. This is particularly true when calculating either a cumulative wealth index or geometric mean, both of which are explain below, because negative return cannot be used in the calculation. The **return relative** solves this problem by adding 1.0 to the total return. Although return relative mat be less than 1.0, they will be greater than zero, thereby eliminating negative numbers.

$$Return relative=RR= \frac{CFt+PE}{PB}$$

1. **Cumulative Wealth Index**

**Cumulative wealth index** is cumulative wealth over time, given an initial wealth and a series of returns on some asset. Return measures such as TRs measure changes in the level of wealth. At times, however, it is more desirable to measure levels of wealth (or price) rather than changes. In other words, we measure the cumulative effect of returns over time given some stated beginning amount, typically $1. To capture the *cumulative* effect of returns, we use index values, which simply means we have a specified beginning value. The value of the cumulative wealth index, CWI*n* is computed as:

CWI*n* = WI0 (1 + TR1)(1 + TR2) . . . (1 + TR*n*)

Where

 CWI*n* = the cumulative wealth index as of the end of period *n*

 WI0 = the beginning index value, typically $1

 TR1,*n* = the periodic TRs in decimal form (when added to 1.0 to the equation, they become return relatives)

Note that the values for the cumulative wealth index can be used to calculate the rate of return for a given period, using the following equation,

$$TRn= \frac{CWIn }{CWIn-1 }– 1$$

Where

 TR*n* = the total return for period *n*

 CWI = the cumulative wealth index

1. **International Returns**

When investors buy and sell assets in other countries, they must consider exchange rate risk. This risk can convert a gain from investment into a loss or a loss from investment into a gain. An investment denominated in an appreciating currency relative to the investor’s domestic currency will experience a gain from the currency movement, while an investment denominated in depreciating currency relative to the investor’s domestic currency will experience a decrease in the return because of the currency movement. To calculate the return from an investment in a foreign country, we use the following equation:

$$Total return in domestic terms= \left[RR ×\frac{Ending value of foreign currency}{Beginning value of foreign currency}\right]- 1.0$$

The foreign currency is stated in domestic terms; that is, the amount of domestic currency necessary to purchase one unit of the foreign currency.

**SUMMARY STATISTICS FOR RETURNS**

The total return, return relative, and wealth index are useful measures of return for a specified period of time. Also needed in investment analysis are statistics to describe a series of returns. For example, investing in a particular stock for 10 years or a different stock in each of 10 years could result in 10 TRs, which must be described by one or more statistics. Two such measures used with returns data are described below.

1. **Arithmetic Mean**

The best known statistic to most people is arithmetic mean. Therefore, when someone refers to the *mean return* they usually are referring to the arithmetic mean unless otherwise specified. The arithmetic mean, customarily designated by the symbol $\overline{X}$ (X-bar), of a set of values is

$$\overline{X}= \frac{\sum\_{}^{}X}{n}$$

Or the sum of each of the values being considered divided by the total number of values *n*.

1. **Geometric Mean**

The arithmetic mean return is an appropriate measure of the central tendency of a distribution consisting of returns calculated for a particular time period, such as 10 years. However, when percentage changes in value over time are involved, as the result of compounding, the arithmetic mean of these changes can be misleading. A different mean, the geometric mean, is needed to describe accurately the “true” average rate of return over multiple periods. The geometric mean return measures the compound rate of growth over time. It is often used in investments and finance to reflect the steady *growth rate* of invested funds over some past period; that is, the uniform rate at which money actually grew over time, per period. Therefore, it allows us to measure the realized change in wealth over multiple periods. The **geometric mean** is define as the *n*th root of the product resulting from multiplying a series of return relatives together, as in the following equation.

G = $[(1 + TR1)(1+TR2) . . .(1+ TRn)]^{1/n}$ – 1

Where TR is a series of total returns in decimal form. Note the adding 1.0 to each total return produces a return relative. Return relatives are not used in calculating geometric mean returns, because TRs, which can be negative, cannot be used.

**Arithmetic Mean Versus Geometric Mean**

When should we use the arithmetic mean and when should we use geometric mean to describe the returns from financial assets? The answer depends on the investor’s objective:

* The arithmetic mean is a better measure of average (typical) performance over single periods. It is the best estimate of the expected return for next period.
* The geometric mean is a better measure of change in wealth over tine (multiple periods) it measures the realized compound rate of return at which money grew over specified period.

**MEASURING RISK**

Risk is often associated with the dispersion in the likely outcomes. Dispersion refers to variability. Risk is assumed to arise out of variability, which is consistent with our definition of risk as the chance of the actual outcome of an investment will differ from the expected outcome. If an asset’s return has no variability, in effect it has no risk. Thus, a one-year Treasury bill purchased to yield 10 percent and held to maturity will, in fact, yield (a nominal) 10 percent. No other outcome is possible, barring default by the U.S. government, which is not considered a reasonable possibility.

1. **Standard Deviation**

The risk of distributions can be measured with an absolute measure of dispersion, or variability. The most commonly used measure of dispersion over some period of years is the **standard deviation** (a measure of dispersion in outcomes around the expected value), which measures the deviation of each observation from arithmetic mean of the observations and is a reliable measure of variability because all the information in a sample is used. The standard deviation is a measure of the total risk of an asset or a portfolio. It captures the total variability in the asset’s or portfolio’s return, whatever the source(s) of that variability. The standard deviation can be calculated from the variance, which is calculated as:

$$σ^{2}= \frac{\sum\_{i=1}^{n}(X- \overbar{X})^{2}}{n-1}$$

Where

 $σ^{2}$ = the variance of a set of values

 $X$ = each value in the set

 $\overbar{X}$ = the mean of the observations

 *n* = the number of returns in the sample

 $σ$ = $(σ^{2})^{½}$ = standard deviation

in summary, the standard deviation of return measures the total risk of one security or the total risk of a portfolio of securities.

1. **Risk Premiums**

A **risk premium** (the additional compensation for assuming risk) is the additional return investors expect to receive, or did receive, by taking on increasing amount of risk. It measures the payoff for taking various types of risk. Such premiums can be calculated between any two classes of securities. An often-discussed risk premium is the **equity risk premium,** defined as the difference between stocks and a risk-free rate (proxied by the return on Treasury bills). In order to maintain consistency with our other series, risk premium are measured as the geometric difference between pairs of return series. Therefore:

ERP = $\frac{(1+TRcs)}{(1+RF)}- 1$

Where

ERP = the equity risk premium

TRcs = the total return on stocks

RF = the risk-free rate (the Treasury bill rate)

Other risk premiums can also be calculated. For example, the *bond default premium* is measured by the difference between the return on long-term corporate bonds and the return on long-term government bonds. This premium reflects the additional compensation for investing in risky corporate bonds, which have some probability of default, rather than government bonds, which do not.

**REALIZED RETURNS AND RISKY FROM INVESTING**

We are now in a position to examine the returns and risks from investing in major financial assets that have occurred in the United States. We also will see how the proceding return and risk measures are typically used in presenting realized return and risk data of interest to virtuallt all financial market participants.

**Inflation-Adjusted Cumulative Wealth** On an inflation-adjusted basis, the cumulative ending wealth for any of the series can be calculated as

CWIIA = $\frac{CWI}{CIINF}$

Where

 CWIIA = the cumulative wealth index value for any asset on inflation-adjusted basis

 CWI = the cumulative weakth index value for ant asset on normal basis

 CIINF = the ending index value for inflation, calculated as (1 + geometric rate of inflation)*ⁿ*, where *n* is the number of periods considered

***Example***

For the period 1920-1998 the cumulative wealth index for the S&P 500 Composite was $3,741.40. the inflation had a total index value of 7.6876. therefore, the real cumulative wealth index, or inflation-adjusted cumulative wealth for period 1920-1998, was:

 $3,741.40/7.6876 = $486.68

Alternatively, we can calculate real cumulative wealth by raising the geometric mean for inflation-adjusted returns to appropriate power:

 $(1.081473)^{79}$ = $486.67

**The Components of Cumulative Wealth** The cumulative wealth index is equivalent to a cumulative total return index and, as such, can be decomposed into the two components of total return, the yield component and the price change component. Because the CWI is a multiplicative relationship, these two components are multiplicative. To solve for either one, we divide the CWI by the other, as in the following equation:

$$CPC= \frac{CWI}{CYI}$$

$$CYI= \frac{CWI}{CPC}$$

Where

 CPC = the cumulative price change component of total return on an index number basis

 CWI = the cumulative wealth index or total return index for a series

 CYI = the cumulative yield component of total return on an index number basis

***Example***

The CWI for common stocks (S&P 500) for 1920-1998 as $3,741.37. The cumulative price change index for common stocks was $118.77, which represents a geometric average annual return of

 $(\$118.77)^{1/79}$ - 1.0 = 1.0623

 = 0.0623 or 6.23%

The CYI for common stocks, therefore, is

 CYI = $3741.37/$118.77

 = $31.50

The compound annual average rate of return for the yield component of total return is

 $(\$31.50)^{1/79}$ - 1.0 = 1.0446 – 1.0

 = 4.446%

Note that the annual average geometric mean return relative for common stocks is the product of the corresponding geometric mean return relatives for the two components:

 GTR = GCY X GPC

 1.10975 = (1.0623)(1.0446)