MODERN PORTFOLIO THEORY

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The purpose of this essay is to present an overview of some of the lessons of modern portfolio theory and capital pricing theory with an emphasis for what they imply for student investing

Fortunately or unfortunately, there is at this time no universally accepted doctrine in finance. Instead there are theories; some perhaps better than others, but each with its own following. Often these competing theories give the fiduciary the same message, but sometimes they give conflicting messages. This essay attempts to point out similarities and differences where appropriate and finally to draw any common conclusions that exist.

This essay is divided into eight sections. Section A introduces some of the concepts and terminology that are necessary to understand later sections. In section B the general theory of portfolio analysis is examined. Section C introduces the basic concept of an asset-pricing model (a model for explaining expected return) and discusses those lessons that can be learned from it. In Section D, other modern of asset pricing and their implications for prudence are examined. Section E deals with investment principles when securities are priced efficiently. If all securities are priced, as they should be, what choices remain for the prudent investor? Section F treats a set of economic principles that should apply regardless of which of the previous theories is accepted. Section G deals with the selection of managers and the management process. Finally, Section H draws and summarizes some general conclusions from the other sections.

Among these conclusions are:

1. Diversification pays
2. Special characteristics of the investor should be reflected in the composition of the investor's portfolio
3. The riskiness of an asset can only be judged in terms of the overall portfolio.
4. The only way to increase expected return on a well-run portfolio is by increasing risk.

5. Investment performance should not be judged over a short period of time (e.g. one year or less)
6. Short selling borrowing options and futures are not per se improper; they can serve useful functions consistent with prudence.

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A. Introduction

All of modern portfolio theory is concerned with the properties of returns from alternative investments vehicles. The concept of return is always defined in terms of cash flow to the investor plus change in market value. To be more precise, the "rate of return" on a security over a particular period is the change in price of the security plus any cash flow that accrues to the holder of the security over the period, divided by the original price of the security. The concept of rate of return does not change in considering different types of assets. For stocks, return consists of both dividends and capital gains, while for bonds it is interest paid plus the change in price, each divided by the price at the beginning of the measurement period. The problems of portfolio theory are complex because future returns, which can rarely be known with certainly, must be estimated. In fact, a risky or stochastic variable must be estimated. If we represent what might happen in the future by what has happen in the past, the distribution of returns for various securities would look like the frequency distributions in Figure1.

There are a huge number of financial instruments and alternative physical investments from which a potential investor can choose, and each would have its return described by a frequency distribution like that in figure 1. It is difficult to make decisions in terms of such distributions or to picture combinations of them. Distributions such as these can be summarized by certain characteristics. For most purposes, it is sufficient to produce two metrics of describe the probability distribution of returns: a measure of central tendency and a measure of dispersion.

The most widely used measure of central tendency is the mean or expected value. The concept of the mean or average return is very familiar. Everyone is accustomed to think in terms of batting averages in baseball or the average time per lap in racing, but an average is insufficient to convey all the information needed to understand the distribution of returns. If does not convey the likelihood of departures from the average outcome-the dispersion of outcomes around the average. It brings to mind the familiar story of the mathematician who drowned in a stream with an average

depth of three inches! The most commonly used measure of dispersion is the variance, or its square root, the standard deviation. The variance is equal to the average squared deviation from the mean.

Returning to Figure 1, it can be seen that common stocks have had a higher average (arithmetic mean) return than long-term government bonds (12.2 percent versus 5.8 percent), but they also have a higher standard deviation of return (20.5 percent versus 9.4 percent). The latter can be seen because the distribution is more spread out (fatter).

Throughout most of this essay when discussing investment decisions, the concern is with both the expected value of returns and the standard deviation of returns. It is not at all controversial to assume that investors like higher levels of expected return. It is also well accepted that most individuals and institutions prefer to avoid risk (in the sense of requiring more expected return to compensate for an increase in risk).

Summarizing a distribution of returns by two measures allows ready computation of the distribution of returns of multiple assets. To get some idea of historical returns and standard deviations, Figure 1 presents the mean return and standard deviation of return for a number of assets over the period of 1926 to 2002. Over the historical period of more than fifty years common equities earned more than twice the return of bonds. However, the standard deviation of return for equities was also considerably higher. To gain some appreciation of this higher variability, recall from mathematics that two-thirds of the time an outcome should be within plus or minus one standard deviation of the mean. Correspondingly, one-third of the time the outcome should be beyond one standard deviation. The mean return for common stocks plus or minus a standard deviation is—8.3 percent to 32.7 percent. Thus, one-third of the time common equity returns should be less than—8.3 percent or more than 32.7 percent.

Figure 1 illustrates a central theme of this essay: To increase the average or expected return on a portfolio, more risk must be incurred. While this point is made on the basis of stronger theoretical grounds subsequently, a quick glance at Figure 1

shows that securities with higher standard deviations tend to have higher expected returns

Perhaps a point that is often neglected in discussions of prudence should be made. Assume that a fiduciary had thought through the goals of the fund the fiduciary manages and has decided that, given the cash flow needs of the fund, it should be entirely invested in stocks. This was done recognizing both the higher expected return on stocks and the higher risk. Assume also that common equities declined in value over the next two years. Does this mean that the decision was incorrect? No. There must always be a differentiation made between ex ante and ex post returns. Investments are chosen based on an *expected* distribution of returns. Over any short to intermediate period, actual outcomes will differ from expectations. Over longer periods, expectations should be more accurate. The performance of managers should not be judged over a short period of time.

As discussed in more detail in following sections, taxes should affect the optimal investment decision. For those investors who are taxed at high rates, investments subject to partial or full tax exemption are especially appropriate. Conversely, investors in low or zero tax brackets should underinvest in or avoid tax-advantaged investments. Because part of the return on these investments is the tax savings, they are less attractive to those who cannot take advantage of this element of return. Thus, taxes are an important element that should affect the investment decision.

Transaction costs are another element that affects the return stream. There are very different transaction costs across different investment alternatives. Government bills have very low transaction costs. Private placement debt, on other hand, has relatively high transaction costs, as do venture capital and real estate. Transaction costs can affect the best way of obtaining a goal. For example, consider the problem of holding a well-diversified portfolio. With only a small amount to invest this can be accomplished, by buying a few shares in each of a number of assets. Because buying a few shares involves large transaction costs, this is a very costly procedure. An alternative way of holding a well-diversified portfolio is to buy a mutual fund.

Although there are additional transaction costs in such a purchase (e.g., a management fee), this may be a les costly alternative.

To gain more insight into how a fiduciary should behave, he lessons of modern portfolio theory must be examined.

B. Mean-Variance Analysis

The tenants of mean-variance analysis are rather simple: Investors prefer high to low return and low to high risk. Given a choice of a 10 percent return versus a 5 percent return with the same degree of certainty, investors would take the 10 percent return. Investors require compensation for taking increased amounts of risk. Given the chance to engage in a gamble with a 50 percent chance of paying $200 and a 50 percent chance of paying zero, an investor will pay less than $100 to take the gamble. How much less than $100 the investor will pay depends on the degree of risk aversion the investor exhibits. (This concept is discussed later.) The important point is not that an investor never takes risks, but that an investor accepts more risk only to obtain a higher expected payoff.

Under mean-variance analysis the important properties of any investment can be summarized in terms of a measure of expected return and a measure of dispersion around expected return, which has already been expressed as the standard deviation or variance. When looking at the characteristics of portfolios, it is possible to find that the expected return of the portfolio is simply a weighted average of the expected return of the individual securities that comprise it, where the weights are the fraction invested in each security. However, the risk (standard deviation) of portfolio is in general less than a weighted average of the risks of the individual securities. In fact, portfolio risk is always less unless the securities have outcomes that vary exactly together (are perfectly correlated). If there is some degree of independence in the outcomes from different investments (the best outcome on one investment does not always happen when the best outcome on another investment is realized), then diversification lowers overall risk. This risk reductions one of the few free lunches in economics. The extent of the

free lunch depends on how closely the two securities move together (the extent of correlation between their returns).

In considering portfolios of several assets, a set of possibilities like those displayed in Figure 2 must be examined. Note the solid black boundary drawn in the diagram. Recognizing nonsatiation and risk aversion as investor attributes, portfolios on this curve can be seen to dominate any of the securities or portfolios not on this curve. For example, consider point A. Clearly an investor would prefer portfolio A' since it has more return than A for the same risk. Similarly the investor would prefer A" to A since it has the same return but less risk. By repeating this for all points in the diagram, it is possible to trace out the boundary curve or "efficient frontier" as outlined. The efficient frontier starts at point G, the global minimum variance portfolio, and extends upward and to the right to point H, the maximum variance portfolio, and extends upward and to the right to point H, the maximum return portfolio. Point G is in general a very well-diversified portfolio, while point H could be a single security. Any investor should choose a portfolio somewhere along the shaded curve. This portfolio dominates all interior points. Exactly where on the curve an investor chooses to operate depends on that investor's personal risk-return trade-off.

Before continuing, two modifications to the efficient frontier must be discussed: What happens when short selling is added, and what happens when lending and borrowing are added?

1. Short Selling

The ability to short sell has two effects on the efficient frontier. As shown in Figure 3, the frontier probably shifts up and to the left, and it continues to the right. The ability to short sell securities creates a new set of possible investments. A security sold short produces a positive return when a security has a large decrease in price and a negative return when its price increases. It potentially improves the efficient frontier (moves it up and to the left) because the ability to short sell doubles the number of possible investments (each stock can be held long or short). Since investors are free not to short

sell, the introduction of the ability to short sell cannot make investors worse off (move the efficient frontier down and to the right). If it never pays to short sell, the worst that can happen is that the efficient frontier is unchanged. Without short sales all investors can do is not hold securities that they believe do poorly. With short sales, an opportunity is created that is expected t have almost the opposite characteristics of the investment when purchased. With short sales t is possible, in a sense, to disinvest in poor investments (hold them in negative amounts) and hence gain if they do poorly. If it ever pays to short sell any security, the efficient frontier is shifted up and to the left. This is an example of the old economic adage that a decision-maker cannot be worse off by being given additional choices and the decision-maker may well be better off. In addition, short sales allow the investor to decrease or eliminate market risk. As later discussed at greater length, in a large, well-diversified portfolio, unique risk is eliminated and only market risk remains. Short sales allow the reduction of market risk to very low levels. As just discussed, the return on a short sale is the opposite of the return on along purchase. About 35 percent of the return on a security is market related. If the market increases, the market return on securities held long is positive. In contrast, for securities held short the return is negative. If the market decreases the opposite occurs. This, the addition of short positions operates as a hedging mechanism, reducing the market exposure of a portfolio.

The extension of the efficient frontier to the right arises from the tendency of a very large amount of short selling to increase the risk and return on the portfolio. This increase in risk is easy to understand. Short sales can involve unlimited loss.

The lesson to be learned from this is that short sales can increase the possible level of return for any level of risk. Short sales can be abused and positions taken that are too extreme. However, short selling per se is not bad. Like any other investment strategy, it can be used prudently or imprudently.

2. Lending and Borrowing

It is necessary to introduce the concept of lending and borrowing. To be realistic, assume that the investor's borrowing rate is above the lending rate. Combinations of lending or borrowing with a portfolio of risky assets lie along a straight line. With lending and borrowing the efficient frontier looks like Figure 4. Notice that for all investors, except for those whose risk-return trade-offs cause them to hold portfolios L and B, the ability to lend and borrow improves their opportunities. The ability to lend (putting part of the funds in government securities) is hardly controversial. The borrowing part may be more controversial. Note from Figure 4 that by choosing point X rather than point Y the portfolio can give higher returns and less risk than buying a more risky portfolio. Comparing Y' and Y in Figure 4 shows that it is possible to achieve a higher expected return at the same risk level of borrowing. Of course, borrowing, like short sales or almost any financial mechanism, can be abused. It can be used to take extreme and imprudent risk positions. On the other hand, it can be used to enhance performance. Rejecting borrowing entirely would throw out positive opportunities. For example, consider an investor wishing to have a portfolio with higher expected return than offered by Portfolio B (e.g., the expected return of Y). This investor would have the same expected return and less risk by buying portfolio B and borrowing than by buying Portfolio Y, which does not involve borrowing.

Returning to the concept of the efficient frontier, it is necessary to delve further into the subject of prudent investing. The solid curve in Figure 4 represents the efficient frontier. An investor should never hold a security or portfolio that lies below the frontier; there is almost never a situation where a single security is efficient. All efficient portfolios are well diversified. The benefits of diversification are achieved with a surprisingly small number of securities.

To get an idea of the impact of the number of securities held on portfolio risk, consider Table 1, which shows what happens on average to the variance of a randomly selected portfolio of common stocks when the number of stocks is changed.

Note that in the move from one to two securities, risk reduced by 42 percent; in the move from one to six securities, it is reduced by 71 percent, and in the move from one to twenty securities, it is reduced by 81 percent. There is till a payoff from further diversification because a twenty-stock portfolio contains 21 percent more risk than a 100-stock portfolio and a 100-stock portfolio contains 5 percent more risk than a 1000-stock portfolio. These results refer to a randomly selected portfolio. With consideration of the risk characteristics, the effect of diversification might be even greater. Of course, diversification is constrained by transaction costs for many types of security.

Another lesson to be learned from mean-variance analysis is the need to focus on the overall portfolio rather than on one asset at a time. Reexamine Figure 2. Many of the dots lying below the efficient frontier represent individual assets. The efficient frontier represents a series of portfolios of assets. It follows that nobody should hold single assets (except perhaps the riskless asset). Single assets are dominated by the efficient frontier. Of course a portfolio on the efficient frontier contains a collection of single assets. An asset might appear undesirable if viewed in isolation, yet have a very desirable impact on a portfolio. For example, an asset might have a high variance and only an average return (compared to the other assets in a portfolio), yet be very desirable addition to a portfolio because it is not correlated (does not move together) with the remaining assets in the portfolio. An asset must always be judged in terms of its impact on a portfolio, rather than in isolation.

Drawing on this general theory of portfolio analysis, economists have sought to develop methods of pricing risky assets, both individually and as part of a portfolio.

C. The Simplest Notion of Equilibrium—The Standard Capital Asset Pricing Model

The most widely used model to explain asset prices is known as the standard capital asset pricing model (CAPM). Developed independently by three well-known financial economists, it is often referred to as the Sharpe-Lintner-Mossin capital asset pricing model in honor of its discoverers. While alternative models that explain why expected

returns differ across assets have been produced in recent years (discussed in later sections of this appendix), the standard CAPM still plays a central role in the financial community.

1. Underlying Assumptions

The CAPM is a model that describes how investors should behave and how prices and returns at which markets clear are set. Before discussing the model in more detail, it is worthwhile specifying the assumptions underlying the CAPM.

The first assumption behind the CAPM is that there are no transaction costs. There is no cost (friction) of buying or selling any asset. If transaction costs were present, the expected return from owning any asset and the desirability of owning it would be function of whether or not the investor already owned it. Thus, to include transaction costs in the model add a great deal of complexity. While transaction costs may be large enough to play a role in the decision-making process of the small investor or in affecting the alternative investments that are close substitutes (as discussed in the previous and later sections of this appendix), they are sufficiently small for enough (large) investors that they should have only a minor effect on equilibrium prices.

The second assumption behind the CAPM is that assets are infantile divisible. This means that investors could take any position in an investment, regardless of the size of their wealth. For example, they can buy $1 of IBM stock. While this is not strictly true for the small investor, given the opportunity to hold commingled funds and mutual funds it is not an unrealistic assumption.

The third assumption is the absence of personal income tax. This means, for example, that the individual is indifferent to the form (dividends or capital gains) in which the return on the investment is received. This is a realistic assumption for pension and other tax-exempt funds.

The fourth assumption is that an individual's or institution's purchases or sales cannot affect the price of a stock. This is analogous to the assumption of perfect

competition. While no single investor can affect prices by an individual action, investors in total determine prices by their actions.

The fifth assumption is that investors are expected to make decisions solely in terms of expected value and dispersion of possible outcomes around expected value (standard deviation)—that they are only concerned with the mean and variance of return. (This is discussed in greater detail throughout this appendix.)

The sixth assumption is that unlimited short sales are allowed. The individual investor can sell short any amount of any shares.

The seventh assumption is that of unlimited lending and borrowing at the riskless rate. The investor can lend or borrow any amount of funds desired at a rate of interest equal to the rate for riskless securities.

The eighth and ninth assumptions deal with the homogeneity of expectations. First, investors are assumed to be concerned only with the mean and variance of returns (or prices) over a single period, and all investors are assumed to define the relevant period in exactly the same manner. Second, all investors are assumed to have identical expectations with respect to the inputs necessary to the portfolio decision. These inputs are expected returns, the variance of returns, and the correlation matrix representing the correlation structure between all pairs of stocks.

The tenth assumption is that all assets are marketable. All assets, including human capital, can be sold and bought on the market.

These ten assumptions obviously do not hold in the real world. The reader should be and is undoubtedly uncomfortable about these assumptions, probably more uncomfortable than he or she is about the fact that many of the design features of the modern car were derived by a physicist under the assumption of a frictionless environment. Yet the model derived under these assumptions, like the physicist's theorem of frictionless movement, sheds light on how the real world operates. Furthermore, by making the assumptions explicit at this stage, the theory can later be modified in the interest of greater realism (as is done later in this appendix).

2. The Standard Capital Asset Pricing Model and What It Implies

If all of the assumptions behind the standard CAPM are accepted, it is possible to arrive at an equilibrium relationship. This relationship expresses the expected return on any asset or portfolio as the sum of two terms. The first term is the compensation the investor would require for giving up the use of funds in an environment that is riskless in nominal terms—called the riskless rate of interest and usually approximated by the rate of return on thirty-day Treasury bills. The second term is the compensation investors require for bearing risk. It is equal to the excess return on the market portfolio (the expected rate of return on the market portfolio minus the riskless rate) times the sensitivity of the security or portfolio to the return on the market. This latter term is usually called beta. This can be expressed as:

$$\textit{Expected return on asset } i = \textit{riskless rate of return} + \beta \times (\textit{expected rate of return on market portfolio} - \textit{riskless rate of return})$$

Some of the terms require more explanation. The market portfolio represents the aggregate of all risky assets—literally all assets with the exception of the riskless asset. Thus, if IBM represents one percent of all risky assets it represents one percent of the market portfolio.

The beta for any security or portfolio is a measure of how sensitive the return on that security or portfolio is to the return on the market portfolio. If a stock had a beta of two and the market return increased by one percent, the return on the stock could be expected to increase by 2 percent.

This relationship is generally known as the security market line. It represents a concrete notion of equilibrium. The expected return for all securities and portfolios is described by this relationship, which plots as a straight line in expected return-beta space as depicted in Figure 5.

Notice that expected return increases linearly with beta. More insight can be gained by realizing that the risk of any stock (its standard deviation) can be divided

into two parts—that due to the market and that not due to the market. The market risk of any security is equal to the product of the sensitivity to the market of a security (its beta) and the risk (standard deviation) of the market. The risk of a security not due to the market is often called its residual risk. This can be represented as:

total risk on security i = the market risk of security i + the residual risk of security i

As increasingly diversified portfolios are held, the residual risks on individual stocks tend to cancel each other out and only market risk is left. Thus, a second set of terminology has arisen. The risk associated with the market is called non-diversifiable risk, and the residual risk is called diversifiable risk. The latter terminology is appropriate, since nonmarket risk tends to go to zero for highly diversified portfolios. The economic intuition behind the security market line is that reward is gained only for bearing market risk (beat), because reward should not be gained for bearing risk that can be diversified away. This, if the investor holds a portfolio with residual risk he or she is taking a risk for which no compensation is received.

In fact, it follows from the standard CAPM that the only portfolio of risky assets that any individual or institution should hold is the market portfolio. The residual risk on the market portfolio is exactly zero, and no other portfolio exists that has zero residual risk. Since the standard CAPM implies that nonmarket risk is not compensated, it should be eliminated. However, there still exists the problem of wanting less risk or more risk than is contained in the market portfolio. The level of risk can be adjusted by simply combining the market portfolio with lending or borrowing to obtain the desired level of risk.

For example, if an investor desires less risk than is inherent in the market portfolio, the investor might place one-half of the funds in the market and one-half of the funds in Treasury bills. If the investor desires more risk, the investor borrows and places his original capital plus the borrowed capital in the market portfolio. This conclusion is so important it has been given a name in the literature—the *two mutual*

fund theorem. It says that all investors can form an optimal portfolio by mixing two mutual funds—the market portfolio and a fund holding the riskless asset. The proportions in which they are mixed is determined by the investor's risk-return preference.

Some of the lessons of the standard CAPM are:

1. An investor is rewarded for taking beta (market) risk, but not for other kinds of risk.

2. The only portfolio of risky assets any investor should hold is the market portfolio.

3. Each investor should adjust his or her overall portfolio to the desired risk-return preference by lending or borrowing.

3. Implications for Investment Behavior

Before discussing the implications for prudence, one caveat is in order. There is one major problem in implementing the standard CAPM, even if belief in it is complete: identifying the market portfolio. This is important enough to merit a separate section, which is discussed shortly. Assume for now that the market portfolio has been identified and can be held at tolerable cost.

a. Holding the Market Portfolio. One of the strongest implications of a strict interpretation of the standard CAPM is that all investors should hold the market portfolio. This is a passive strategy. It not only involves no forecasting of security or asset performance, it implies that spending money on such forecasting is foolhardy.

Perhaps a slightly less strict interpretation would say that any deviation from holding the market portfolio requires justification. If a security or class of securities were perceived as being out of equilibrium (offering a return above that specified by

the security market line), then an action in deviating from the market portfolio might be defended. The investor, however, would have to be able to specify that the deviations were sufficient to cover:

1. The extra transaction costs involved in deviation from the market.

2. The diversifiable risk incurred in deviating form the market portfolio.

3. The costs of analysis incurred in finding the "underpriced" securities.

b. Leverage Is Permissible. Under the CAPM, the only way to increase is to increase risk. If an investor wants more return than is expected form the market portfolio he or she must incur more risk. If a higher risk return position is warranted by the objectives of the investor, the only efficient way to get there is to borrow to increase the investment in the market portfolio. Trying to increase return by deviating the investment in the market portfolio (buying more high beat-stock) is inefficient, for deviations from the market portfolio introduce residual (diversifiable) risk. Residual risk does not increase expected return. The implications of the CAPM cannot be accepted without accepting leverage as a viable investment strategy.

c. Potential for Negative Results. The believer in the standard CAPM must keep in mind that this is an expected value theory. Realistically, expectations are met only in the long run. In the short run there is nothing unusual about returns deviating from what is expected. Thus, the theory should only describe what happens over very long periods of time. Over short periods, the theory won't describe reality. For example, holding a high-beta (e.g., leveraged) portfolio should produce high returns over a long period of time, but over short periods it may produce low or even negative returns. The explanation for this is easy to see. High-beta portfolios give high expected (long run) returns because they are riskier. If they always (over every time period) gave

higher returns they would not be riskier. If an investor cannot bear adverse outcomes in the short run that investor should not be following a high0beata strategy.

4. Problems With the Market Portfolio

Until now, the assumption has been that the market portfolio was easily identifiable. In fact, according to the CAPM, the market portfolio should include all risky assets, each in proportion to the share it claims of the aggregate of all risky assets. This makes the market portfolio difficult to identify and has other major implications for investor behavior.[10]

Under the tenets of the standard CAPM, no investor should be criticized for holding a particular type of risky investment; in fact, depending on the circumstances, an investor might be criticized for not holding it. As an example, consider so called junk bonds. These bonds are low rated but have higher yields. When viewed in isolation, the bond of an issuer that might go bankrupt could be considered an imprudent investment. However, if the tenets of the CAPM are accepted, the residual risks are diversified away and the extra return promised by junk bonds provides the correct level of compensation for the risks involved. It is important to stress that the theory *cannot* be interpreted two ways. If an equilibrium model holds, then all assets should be purchased. If an equilibrium model is acted on, eliminating securities with a probability of bankruptcy from the portfolio required as much justification as trying to pick winners. Once again, transaction costs, the cost of bearing diversifiable risk, and the cost of analysis must be covered.

If the use of passive portfolio is supported on the basis of general equilibrium models, the widest possible interpretation of a market portfolio must be supported. Holding an index fund (market portfolio) of common stocks without the inclusion of debt instruments is not consistent with equilibrium theory. Indeed, a correct passive portfolio must theoretically include the full range of risky assets, including such items as commodities, junk bonds, small stocks, real estate, and collectibles.

If a class of assets is left out of a portfolio, the burden of the proof for leaving it out should rest on the investor. Since the managed portfolio should replicate the market portfolio of all risky assets, the more important (the larger the total dollar value of) a type of asset excluded from the portfolio, the more harm is done by excluding it. As a practical matter, types of assets might be reasonably excluded because of large transaction costs, which included the costs resulting from illiquidity.

An index fund of stocks might be part of a market portfolio, but it should be *only* a part. Even when considering the universe of stocks, care must be taken. Most index funds attempt to duplicate come market index—typically one like the Standard & Poor (S&P) index, which only includes large stocks. This is inappropriate because all stocks, including over-the-counter stocks, should be included. There are differences in the performance of large stocks and small stocks. There are differences in the performance of established enterprises and new ventures. These differences cannot be ignored. The theory calls for the inclusion of all stocks, including those that may have traditionally been thought of as highly risky.

There is one other point that should be made in this section. Even under the standard CAPM and its implication of holding the market portfolio, a little thought will show that the assets held in the "market" portfolio might vary from investor to investor. Take the case of a pension fund administrator for a steel company. If a major assets of that fund is the future payment stream coming from the steel company, then a disproportionate amount of the fund's wealth is sensitive to the economic performance of the steel industry and hence the performance of steel stocks. It would be desirable for the common stocks held by this fund to include no steel stocks. In fact, it is possible to go further and argue that the fund should be underweight (hold less than market weights) in other stocks that move closely with the fortunes of the steel industry (perhaps other metal stocks or auto stocks). Considerations such as these have been discussed in the literature of financial economics, and conclusions like those described above have been reached.

It may seem from the foregoing discussion that the practical problems with assembling the market portfolio are so numerous (such as the liquidity problems

associated with holding art and other collectibles) as to render the effort futile. This conclusion exaggerates the importance of the difficulties in achieving a true "market" portfolio. Even if whole categories of assets (such as collectibles) are excluded for practical reasons, a large fund should still be able reasonably to approximate the market portfolio.

D. Other Equilibrium Models—Implications for Other Passive Portfolios

In the last section, one model for explaining why expected returns differ across assets was discussed. A large number of alternative models have been proposed for explaining why expected returns differ across assets.

Furthermore, there is empirical evidence that suggests that these alternatives may be more descriptive of reality than the standard CAPM. In this section, these alternative models are discussed, along with the optimal portfolio strategy they lead to and the implications these investment strategies have for prudence.

Alternatives to the standard CAPM are of two types. One type is derived by continuing the CAPM's assumption that investors are only concerned with the mean and variance of return, but relaxing one or more of its other assumptions. The second type, known as arbitrage pricing theory (APT), proceeds from assumptions about what factors affect returns. It does not require that investors be mean-variance maximizers.

1. *Equilibrium Models Based on Assumption That Investors Use Mean-Variance Analysis*

As discussed previously, the standard CAPM rests on ten assumptions, one of which is that investors are concerned only with mean and variance of returns. What distinguishes alternative models is a relaxation of one or more of those other nine assumptions. For example, the effect of taxes or of inflation may be taken into account.

a. *The Zero Beta Capital Asset Pricing model.* The most popular alternative to the standard CAPM is the so-called zero-beta CAPM. One of the assumptions that bothers people about the standard CAPM is that investors can not only lend, but also borrow, at the same riskless rate of interest. Investors can purchase Treasury bills, and instrument generally assumed to be riskless. Likewise, investors can buy federally insured certificates of deposit from major financial intermediaries. While these instruments may have some default risk, this risk is so small that assuming them to be riskless is reasonable. However, investors cannot borrow at the same rate as the federal government or large commercial banks. Thus, an assumption of an ability to borrow and lend at the same riskless rate is probably sufficiently unrealistic as to affect asset pricing. Figure 6 depicts the investor's choice when there is a differential lending and borrowing rate.

The efficient frontier becomes A L B C. The market portfolio is on the efficient frontier, lying on the curved portion between L and B. However, unlike the standard capital asset pricing model the *market portfolio is no longer optimal for all investors.* Investors may find portfolios along the line segment A L more desirable. These would be obtained by putting part of a fund in the riskless asset and part in risky portfolio L, which would have a beta lower than one. Portfolios composed solely of risky assets and lying on the curved segment GL would be inferior. This, it is preferable to obtain lower risk by mixing a reasonably risky portfolio L with the riskless asset rather than by placing 100 percent of the fund in a low-risk portfolio. Whether or not a portfolio lies on GL may be difficult to determine. However an investor who knowingly chooses such a portfolio would be imprudent, since a higher return could be obtained for the same risk by mixing L and A. A particularly interesting portfolio is G. G is the least risky portfolio of risky assets available. However, if it is possible to lend at the riskless rate (and buying Treasury bills is clearly possible), it is imprudent to invest even in the least risky portfolio of risky assets, because the same expected return can be achieved at a lower level of risk by lending.

Another feasible set of risky portfolios is that lying on the segment LB. One of these portfolios is the market portfolio, but there are other risky portfolios on this

segment. The most risky portfolio that can be held is B. An investor desiring to hold a portfolio along the line segment BC would invest the whole fund, plus an additional amount obtained by borrowing, in risky portfolio B. Thus, with differential lending and borrowing rates three possibilities can be observed:

1. Investors putting part of their fund in L and the remainder in a riskless asset.
2. Investors putting 100 percent of their fund in a risky portfolio.
3. Investors borrowing and putting more than 100 percent of their fund in portfolio B.

Investing 100 percent of an investor's money in a market portfolio of risky assets has often been suggested as the only appropriate strategy. This conclusion rests on the unrealistic assumptions underlying the standard CAPM. Relaxing the assumptions invalidates this prescription. This is obviously the case when lending and borrowing rates are different. A similar result follows when other assumptions are relaxed, as discussed in subsequent sections. Thus, authors advocating an investment strategy of 100 percent in the market portfolio as the only prudent investment must defend either the assumptions underlying the standard CAPM or its descriptive power! This prescription is not robust to slight changes in assumptions.

If Figure 6 is a reasonable representation of how investors act, then expected returns on assets should be determined by the zero-beta CAPM. This same CAPM results from an assumption of differential lending and borrowing rates or an assumptions of lending at the riskless rate but borrowing being prohibited or an assumption of neither lending nor borrowing at the riskless rate.

The reason for the term "zero beta" should now be clearer to readers. If the zero-beta CAPM holds, the expected return on any asset depends on the expected return on a portfolio uncorrelated with the market (the zero-beta portfolio) and the expected return on the market.

Empirical evidence on balance is more supportive of the zero-beta form of the CAPM than the standard CAPM. Investment advisers probably use the zero beta

CAPM most often to aid them in spotting underpriced securities. Thus, empirical evidence would support the reasonableness of a wide variety of portfolios being appropriate for different investors subject to the prudence standard.

b. *The After-Tax Capital Asset Pricing Model*. The second most frequently relaxed assumption underlying the standard CAPM is the assumption that investors make decisions on the basis of pre-tax returns. If cash flows from all potential investments are taxed at the same rate, then making decisions on the basis of pre-tax flows would be equivalent to making decisions on the basis of pre-tax cash flows would equivalent to making decisions on the basis of post-tax cash flows, and the standard CAPM would not have to be modified even though taxes are paid on investment returns. However, differential taxation of investment cash flows is a prominent feature of the tax law. For example, capital gains are taxed at a different rate than dividend income. Likewise, municipal bonds are taxed at more favorable rates than government bonds. Even for tax-exempt funds, there are differences. If a tax-exempt fund borrows to invest, the leveraged returns are taxed at ordinary corporate rates.

The tax feature that has been incorporates into the after-tax CAPM is the differential taxation of capital gains and ordinary income. It should be pointed out that not all researchers accept the importance of this distinction. Differential taxations of capital gains and ordinary income has clearly been a feature of the U.S. tax system over much of its history. What is important, however, is the effective rate paid on these two streams. Some researchers have argued that dividend income allows greater write-offs of interest expense, thus lowering the effective tax rate. If it is lowered sufficiently, then the rate on ordinary income and capital gains could be essentially the same, and looking at the pre-tax returns would be appropriate. Although some observers make this argument and some empirical evidence supports it, the bulk of the evidence is in favor of an effective differential in the taxation of ordinary and capital gains income.

One implication of the after-tax CAPM being the appropriate description of reality is that once again it is no longer optimal for all investors to hold the market portfolio. The deviations from the market portfolio depend on the investor's tax

bracket relative to the tax bracket affecting market prices. If the investor's tax bracket is greater than the bracket that determines market pries, then a portfolio with more than market representation in low-dividend stocks is the preferred portfolio.

It may seem that there are so many possibilities that no portfolio of risky assets can be deemed imprudent. As noted earlier, this is not the case. A portfolio composed solely of risky assets on the efficient frontier would nonetheless be inferior to a portfolio involving lending with higher return and the same risk or the same return at lower risk. In addition, the earlier analysis clarifies the reasoning behind certain investment strategies. For example, because of the way differential tax rates affect the pricing of assets, a fiduciary for a tax-exempt fund seeking to use primarily low-dividend stocks should have the burden of showing that:

1. The fiduciary had a special ability to select undervalued low-dividend stocks.
2. This special ability was likely to produce extra returns that more than compensate for the benefits that high-dividend-paying stocks offer to tax-exempt funds.
3. The special ability to select undervalued stocks was not transferable to those paying high dividends.

c. Inflation-Adjusted CAPMs. A number of CAPMs assume that inflation affects the equilibrium of expected return on securities. The underlying assumption of these models is that asset returns are differentially affected by inflation. Once again, the important element is that inflation affects securities differently. This causes inflation to be an important consideration. If inflation had a constant effect on all securities or if the effect of inflation on an individual security varied randomly across securities, then inflation need not be explicitly incorporated in the equilibrium asset pricing model.

If inflation is important, then investors should hold efficient portfolios where returns are defined in real terms rather than in nominal terms. Since the rate of inflation is uncertain, nominally riskless assets are risky in real terms. In the U.S.

economy there is no asset whose return is adjusted by inflation and therefore riskless in real terms. Thus, in the U.S. economy there are no riskless assets in real terms.

Without a riskless asset, a wide rang of portfolios is reasonable to hold from an investor's point of view. The zero-beta form of the CAPM in real terms should explain expected returns. Very little can be said about the characteristics of efficient portfolios other than that they are widely diversified; the market portfolio is one candidate, but so too are the other risky portfolios lying between L and B in figure 6. The major point to keep in mind is that given the existence of uncertain inflation, the set of portfolios that a prudent investor might hold includes a wide range of highly diversified portfolios with the market portfolio reaming as one (but by no means the only) possible candidate.

d. Nontraded Assets and the CAPM. Some assets are not traded. The most notable of these is human capital. In this society, an investor cannot buy or sell another's right to future income. Thus, human capital is nontradable. A second example is a home. Homes, of course, are clearly tradable. However, most individuals do not trade their homes to rebalance their portfolios. Thus, investors may, in essence, be treating their homes as nontradable. The effect of nontradable assets is that each individual 's portfolio should be custom designed. A portfolio should have underrepresentation of assets that are highly correlated with non-traded assets. For example, a steel executive whose income is highly affected by the performance of the steel industry should hold fewer assets whose performance is also affected by the steel industry than should the average investor. If nontraded assets are important, custom design of portfolios is necessary.

d. Other CAPM Models. There are a number of other CAPM models. Some allow for the inclusion of other assets, such as assets with returns denominated in currency other that the investor's home currency. Other nonstandard CAPMs incorporate the effect of some investors having an effect on price when they trade, and some are derived form an assumption that investors consider more that the mean and variance of the

distribution of returns in making portfolio decisions. These models bear some resemblance to arbitrage pricing theory models, but they differ in that they are derived from, and the form of the of the model id determined by, consideration of formal utility theory rather that by consideration of the return generating process. The main implication of these models is that holding the market portfolio is no longer an optimal strategy for all investors. Rather, investors choose from a wide range of optimum portfolios. These cannot be specifically characterized, as were prior models. Thus, a more detailed discussion of each unwarranted.

2. Non-Mean-Variance Equilibrium Models

Each of the models discussed previously relies on the assumption that investors are mean-variance maximizers. There is an alternative to this class of models. The alternative theory is called arbitrage pricing theory (APT). The name "arbitrage pricing theory" arises from the assumption that investors will arbitrage away any differences in the expected return on assets that have the same risks. Of course, the same assumption underlies the standard CAPM. The basic assumption of APT is not that investors are mean-variance maximizers, but rather that returns are affected by systematic influences that can be specified. The relationship between these systematic influences and the return on any asset over time is called the return generating process. Examples of such systematic influences might be changed in oil prices or interest rates or steel prices. Not all of those influences are priced (i.e., offset expected or equilibrium returns). Part of APT consists of specifying those influences in the return generating process that are priced.

What are the implications of APT for investment theory? First, there is a distinction between priced factors and unpriced factors. The return on a security is likely to be affected by both factors that are general to all securities and factors that are only important to a subset of securities. The effect of the general factors is unlikey to be eliminated in a large portfolio. Thus, these factors affect the expected return on all assets. The effect of factors that only affect a subset of securities is likely to be

eliminated in a large portfolio. Thus, sensitivity to these factors does not result in higher expected return. As a concrete example, suppose that seven factors affecting the economy can be identified. Four of the factors are pervasive and, therefore, affect expected return (are priced) because they cannot be eliminated through diversification. Three of the factors are not pervasive in their influence because they affect only some segments of the economy. Since these risk factors can be diversified away, they do not affect expected return (are unpriced).

The separation of priced factors from unpriced factors is an important concept for investor behavior. Assume there is a steel factor that is not pervasive enough throughout the economy to be priced. An investment manager who concentrated on selecting steel companies would bear the extra risk of this factor without earning any additional expected return. Such a strategy would be detrimental unless the manager could demonstrate two things: *first*, sufficient expertise in selecting steel stocks to more than compensate for the extra risk, and *second*, the nontransferbility of this expertise to a broader range of securities.

Constructing a portfolio that is sensitive to priced factors involves a different consideration. Since sensitivity to priced factors involves extra return, the choice of sensitivity to priced factors is a risk-return trade-off. The choice is neither good nor bad per se but depends on the goals (risk-return preferences) of the fiduciary making the choice.

There is a third issue that can be analyzed in the APT framework. This is the effect of other income on the choice of an optimal portfolio. Assume the investor has other income besides the income from their investment portfolio. Furthermore, assume this income is related to factors that affect a security's returns. Then the risk on the combination of the other income and the investment portfolio is reduced if the sensitivity of the investment portfolio to factors that also affect other income is lowered.

Arbitrage Pricing Theory is the newest widely acknowledged theory in finance. The lessons to be learned from it are:

1. A portfolio may have to be constructed to take account of the risk of several systematic influences in addition to market movement. If these systematic risks are priced, an investor will be compensated for taking them, just as the CAPM suggests one is compensated for assuming greater market risk.
2. Risk may have to be measured by sensitivity to each of those systematic influences.
3. The market portfolio may play no unique role as a model for judging performance or as a benchmark passive strategy.

However, the theory is so new that the relevant influences have not yet been discovered. At this time, only these broad implications can be outlined.

E. Efficient Market Theory

Each of the models discussed thus far can be viewed as being consistent with the notion of fair prices existing in the market or of the market being efficient. A more detailed discussion of what "efficient markets" really are and what they imply for the prudent investor follows.

A great deal of research has attempted to show that security markets are informationally efficient. The basic concept is that information is impounded so quickly into the share price that by the time the investor can take advantage of the information it is already reflected in the share price. Consider the following example. Assume the firm announces earnings of $3 when analysts had been expecting $1. This is clearly good news. The expectation is that share prices rise in order to reflect this news. In an informationally efficient market, before an investor could place the order, the share price would have already risen to an unbiased estimate of its final price after adjusting for the earnings announcement. In an informationally efficient market, the share price of an individual security might rise or fall after the initial adjustment as the analysts evaluate the meaning of the unexpected high earnings are extraordinary earnings (perhaps associated with the sale of an asset), then the stock price should fall as analysts learn that the earnings surprise is a one-time phenomenon. However, in an

informationally efficient market, buying large number of similar companies with unexpected earnings surprises does not lead to excess returns.

The concept of efficiency is closely related to the concept of a fair game. If the securities market is a fair game, then there is no way to use information available at any point in time to make a profit beyond that which is consistent with the risk inherent in the security.

This discussion may seem either intuitively obvious or completely unappealing. To further clarify the discussion, some conditions under which it would not be correct must e specified. Assume that an investor has information that is *not* incorporated in the stock price when he buys but which will be incorporated soon thereafter. For example, suppose a government employee in charge of military contracts is about to approve a large contract for a small and previously unused supplier of butter to the army. This contract will result in a huge increase in profits for the company, but the market has assessed the probability of the company getting it as very small. Thus, only a fraction of the potential profits are incorporated in price. The procurement officer could make a much larger return than equilibrium return for this company by purchasing its stock. The fair game model would not hold with respect to the procurement officer. Thus, if the information available to an investor is not incorporated in price, the fair game model does not hold with respect to that information.

The informational efficiency literature has been divided into three groups depending on the information with respect to which the market is efficient. These groups are called weak form, semi-strong form, and strong form. For weak-form tests, the information set is the past history of stock prices and past trading volume. For semi-strong form-tests, the information set is one or more pieces of publicly available information. Finally, for strong-form tests, the information set is all information, whether public or not, that is at the disposal of any group of investors.

To test any fair game model, an estimate of expected returns is required. There have been many choices. For some tests, the actual return in the preceding period is used as an estimate of expected return. In other cases, the estimate of expected return

is implied from some model. The most commonly used model is the standard CAPM discussed previously. However, other models have been used.

The evidence on informational efficiency is discussed throughout and no additional detailed discussion is necessary. However, some general conclusions should be presented. Most evidence shows that there is a very small correlation between past returns and future returns. Tests that have examined whether the small amount of information in past returns can be used to earn abnormal profits have been negative. Thus, researchers feel that markets are weak-form efficient. The evidence on strong-form efficiency looks primarily at the effects of insider trading. Insiders are clearly privy to nonpublic information. It should be expected that such information leads to excess returns. However, taking advantage of this information is illegal. Evidence supports the notion that insiders make excess returns and, accordingly, that markets are not strong-form efficient. Evidence on semi-strong-form efficiency is mixed. By and large, new information seems to be fully incorporated in share price within a day or two of the announcement. However, for the market to be truly informationally efficient, the impact of information should be immediate. This does not seem to be the case. Some abnormalities or inefficiencies that seem to be present are discussed later.

1. *Implications of the Efficiency Literature*

Consider for the moment the impact of an earnings surprise. Assume that the evidence is that earnings surprises are rapidly and unbiasedly incorporated in share price. What is left for the fiduciary to do? There are two aspects of the evaluation process for which there is little or no empirical evidence. First, are there some analysts that better predict earnings surprises and second, can some analysts better estimate the impact of an earnings surprise?

Prospective earnings surprises lead to a favorable impact on share price on average. However, after an earnings surprise some firms' prices decline rather than rise. Excess profits could be made if it were possible by superior analysis both to predict earnings surprises and separate out those firms whose shares will rise rapidly

upon announcement of such a surprise. However, there are very few tests concerning the ability to forecast surprises or concerning the ability to better analyze the impact of announcements on earnings. There is one recent study, Dimson and Marsh [9], that does indicate that analysts may be able to identify stocks that will outperform a passive strategy, although this study does not focus on the prediction of earnings.

2. *Implications of Completely Efficient Markets*

Assume that markets are completely efficient in the sense that information is rapidly incorporated in share price, analysts have no ability to forecast surprises, and they do not have any special ability differentially to analyze the impact of new information. What, then, is the role of investment managers?

First some misconceptions must be discussed. It is often stated that in an efficient market the only appropriate strategy is to hold the market portfolio. This does not logically follow. Holding the market portfolio is one implication of the standard CAPM. Yet market efficiency is also perfectly consistent with any of the other equilibrium models. For example, efficiency of the market would be consistent with the zero-beta form of the CAPM. As discussed previously, assuming the zero-beta CAPM holds does not imply that investors should hold the market portfolio. If taxes are important, then investors should tilt their portfolios to take advantage of their relative tax status. If one owns nontraded assets, portfolios should be designed to underinvest in assets highly correlated with the nontraded assets. In short, the appropriate investment strategy discussed in the sections on equilibrium models is unchanged by the concept of informational efficiency.

However, market efficiency does not require that any of the equilibrium models discussed previously holds. What is the appropriate investment strategy if an investor is unwilling to accept any of the equilibrium models discussed earlier? Without an equilibrium model there is no necessary relationship between expected return and risk. Without an explicit tradeoff between risk and return, the appropriate strategy is simply

to reduce risk. If no estimates of the risk of individual securities are made, then equal investment in each security is appropriate. If estimates of the risk structure are made, then a strategy to minimize risk is the appropriate passive strategy, and all that can be strongly asserted is that the portfolio should be well diversified.

3. Evidence of Market Inefficiencies

Research over the last five years has produced a growing body of evidence that even one of the most efficient markets (the New York Stock Exchange) has inefficiencies. One of the most often quoted inefficiencies is the size effect. It has been well documented that, after adjusting for risk, small firms have higher realized returns than large firms. A number of authors have attempted to explain the small-firm effect by arguing that the risk for small firms was underestimated or by explaining it in terms of some other missing factor. However, to date no satisfactory explanation exists for the small-firm inefficiency.

Another inefficiency that has received attention is the P/E effect. Once again, after adjusting for risk, low P/E firms give higher returns than high P/E firms. There is a high correlation between firm size and P/E, so that the small-firm effect and the P/E effect may be similar phenomena. However, once again no satisfactory explanation exists. Because size and P/E are easily observed, it is surprising that any information contained in these variables is not already incorporated in share price.

Another inefficiency is known as the January effect. A great deal of literature has been produced that supplies evidence that securities yield high excess returns for the entire month of January. Recently this phenomenon has been tied in with the small-firm effect. For example, Keim [19] presents evidence that about 25 percent of the size effect occurs during the first five trading days in January. A natural explanation for this might be tax-loss selling. Roll [26] presents this position and suggests that the phenomenon is larger for small firms since these firms are unlikely to be held by large institutions. Reinganum [25] shows that the small firms tend to produce larger returns for the first five days in January whether they showed capital loss hypothesis. This view

gets further support from Berges, McConnell, and Schlarbaum [3], who find a small-firm January effect in Canada but the effect is present both before and after the introduction of a capital gains tax.

Some other inefficiencies are less surprising. There is growing evidence that analyst forecasts contain valuable information. There is evidence that certain analysts seem to be able to forecast earnings or returns above what could be explained by chance. Forecasts by internal analysts employed by fiduciaries are, of course, not widely available to the investing public. Thus, inefficiency with respect to these estimates is more difficult to eliminate than that due to widely available information such as firm size, and one could thus expect this effect to be more persistent.

The inefficiencies discussed above are a subset of those that have been documented. Over time, many will disappear as more accurate measures of risk are developed. However, new inefficiencies are likely to be discovered. The important point is not merely to identify those inefficiencies that have been discovered but rather to recognize that inefficiencies exist and are likely to continue. In the early years of the efficient market literature, adherents argued that markets were so efficient that hiring professional managers was a waster of resources. While this literature is a welcome caution on how much professional management can add to value, current evidence would indicate that active management can, in some cases, add sufficient return to justify its cost.

In summary, the state of the efficient market literature would seem to suggest that while markets are almost efficient, anomalies exist. The concept of a totally efficient market for all assets suggests a completely passive strategy on the part of the investor. Exceptions from efficiency suggest that investors can and perhaps should in some cases deviate from a passive strategy, but they must be able to document the reason for and process of this deviation. (This is discussed further in Section G.)

F. Other Considerations in Portfolio Management

In preceding sections, standard portfolio theory, general equilibrium theory, and efficient market theory are discussed. Here, some topics that are important in the investment area but that do not fall into any of the earlier categories are discussed.

1. The Importance of the Investor's Horizon

Consider a pure discount or zero-coupon bond. The only cash flow to the investor in this instrument is the cash flow at maturity, which incorporates both return of principal and interest. Without intermediate cash flows, there is no risk of reinvestment. Examples of pure discount instruments include Treasury bills and stripped government bonds (e.g., Tigers and Cats). An investor whose horizon exactly matches the maturity of the pure discount instrument has zero risk (ignoring the risk of default). An investor with any other horizon bears interest rate risk. This is a dramatic example of the effect of the investor's horizon on the riskiness of an investment strategy. The same effect can be seen with other strategies. For example, over long periods common equities have outperformed bonds as an investment strategy. However, the month-to-month and year-to-year variability of common equity is substantially higher than bonds. Thus, any investor with a long horizon should favor equities relative to an investor with a shorter horizon.

2. Importance of risk Preference

Various equilibrium models and the passive strategies to which they led were previously discussed. Except in the extreme case of the standard CAPM, a number of alternative portfolios of risky assets are potentially optimal for a fiduciary. When a number of portfolios are on the efficient frontier, modern investment theory posits that the choice among them depends only on the fiduciary's risk-return preference. Without an analysis of the fiduciary's risk preferences, the choice among portfolios

cannot be made. The point is not that explicit guidance can be given, but rather that an optimum portfolio does exist, and its makeup depends on the fiduciary's risk-return tradeoff. Thus, except in the case where the standard CAPM is accepted as the appropriate model for all asset pricing, some evidence of an analysis of the investor's risk preference should be present.

3. Effect of Maximum Loss

A number of investment programs have a specific minimum cash need. Returns above the stated cash requirements are useful but are not as important as the ability to meet the scheduled cash need. In other words, there is an asymmetry in the outcomes. Failure to meet the demand for cash is extremely serious while extra returns, although beneficial, have less value. This kind of asymmetric reward should be incorporated in the investment strategy. It can be incorporated in a number of ways. It might be reflected in a two-portfolio strategy. Here, the first portfolio would contain assets of low risk and of a size sufficient to meet the target return. The second portfolio would be more aggressive, designed to provide extra return. A second alternative is to construct one aggressive portfolio but to also buy a put against it. The put would have an exercise price equal to the amount of money necessary to be put aside in order to meet the target. The active portfolio would not have any special characteristics that would identify it as useful for meeting the target return.

4. The Effect of Illiquidity

A number of investment alternatives are not easily sold. Privately placed real estate is am example. Many mortgage loans or loans with equity kickers would be other examples. The characteristic of most illiquid investments is that they offer a higher return than corresponding liquid investments. For a portfolio with no immediate cash needs, investments like these may well be preferred given the additional return they offer. However, of the fund has cash needs or can have unanticipated cash needs, then

some provision to accommodate such needs is necessary. Thus, the prudent investor must explicitly examine potential needs for cash withdrawal. Furthermore, the amount invested in illiquid investment must be related to the potential cash needs of the portfolio.

5. Judging Securities and Techniques by Their Purpose

Securities can be used in combination to generate a portfolio that has all the characteristics of a portfolio composed of very different securities. The simplest example is artificial options. It is well known that any arbitrary portfolio of common equities can be combined with Treasury bills in such a way that the combination has the same characteristics as owning the underlying stock portfolio plus a put option on that portfolio. The creation of artificial puts involves a shift from equities to Treasury bills as stock prices decline and shift from Treasury bills to equities as stock prices rise. This dynamic portfolio adjustment causes the combination of an equity portfolio and a portfolio of Treasury bills to replicate the return pattern of the equity portfolio plus a put option on that portfolio. The construction of an artificial put involves continual adjustment of the bond stock mix in a predetermined manner. The underlying point is that the reasonableness of any investment decision should be judged in terms of the purpose sought to be achieved in the context of overall portfolio management. If the decision to hold Treasury bills with a particular stock portfolio is based on the idea of combining a risky portfolio with the "floor" that a put option creates, its prudence must be tested on how well that goal is achieved rather than on the merits of just holding Treasury bills and the risky portfolio.

6. Dominated Securities

A prudent investor should not hold a dominated security. The simplest example of a dominated security is a nongovernment bond having a lower yield than a government bond obtainable at the same price and with the same maturity yet with no special

characteristics such as an advantageous tax status. Government bills are considered to be free of default risk. A number of banks offer C.D.s at much lower rates of interest than can be obtained on a government bill with the same maturity. These instruments are riskier than government debt. A prudent investor does not invest at lower interest rates when higher interest rates are available in less or equally risky instruments. While this is the most obvious example of dominated securities, other examples exist.

Many funds try to earn extra return by making timing decisions on when to invest in various categories of securities. The most common of these is the bond stock mix. A manager switches between bonds and stocks in anticipation of changes in the relative performance of these instruments. To market time in this manner an investor incurs the cost of buying and selling the securities. There is an alternative way to carry out a market timing strategy. This involves taking positions in futures. For example, assume an investor wished to increase equity exposure relative to debt exposure. This can be accomplished by purchasing equity futures and selling debt futures. Futures transactions are considerably cheaper than transactions in the underlying security. If the portfolio is highly correlated with a portfolio for which futures exist, then timing by futures dominates timing by changing the underlying securities held in the portfolio. Even if an investor's portfolio is very different than the portfolio for which futures exist, timing by futures may be preferred. There is an added risk when the portfolio differs from the portfolio on which futures are written. This risk is one of adverse changes in the relative performance of the actual portfolio invested in and the portfolio against which futures are written. The choice of timing method depends on an evaluation of this added risk compared with the savings in transaction costs through use of futures.

G. Portfolio Strategy Development and implementation

One of the most difficult aspects of portfolio management is the selection of a strategy and one or more managers appropriate to effect it. This entire appendix has been, in part, concerned with this issue—it is now time to reexamine it.

This investment process should start with a set of goals. Vague intentions such as "I want to maximize return and not take much risk" are no longer sufficient. The concern must be with managing both risk and return. Return can be decreased, and risk increased, through imprudent management. But given prudent management, the only way to increase expected return is through bearing more risk. The amount of risk that an account can bear and the tradeoff between risk and return that a fund sponsor will take must be thoroughly analyzed. Courts must realize that minimizing risk is not the only defensible strategy and that in fact, as discussed earlier, minimizing the risk on the portfolio of risky assets may be an imprudent strategy. Placing 100 percent of funds in Treasury bills is safe in terms of the default risk, but there is an opportunity cost in foregone returns as well as the risk of inflation. If any bad outcome is taken as a sigh of imprudent management, then all managers are forced to take low-risk, low-return strategies. Obviously the other extreme of adopting a high-risk, high-return strategy is not appropriate for most investors. Even a long-tern investor with small intermediate cash flow needs has to be alert to the danger of gambling ruin in the short run. Fiduciaries should always be concerned with the balancing risk and return.

The fiduciary must formulate a set of goals delineated, at the very least, in terms of risk and return. The goals should, at a minimum, also specify constraints on liquidity as appropriate for anticipated cash outflows and consider the tax implications of any investment policy.

Once goals are established, an appropriate passive strategy should be formulated to meet these goals. A considerable amount of time has already been spent discussing passive portfolios. While slavishly following a passive strategy is not advocated, an appropriate passive strategy serves as a benchmark to help select managers or management philosophies and as a way of monitoring performance over time.

While the selection of an optimal portfolio is not easy, and in fact there is probably not a single, truly optimal passive portfolio for a fiduciary, the selection of an appropriate passive portfolio, consistent with goals and circumstances of a fiduciary's situations, places the rest of the investment in its proper perspective.

To select the passive portfolio, the fiduciary must examine his goals in terms of risk and return, special liquidity needs, special tax treatment, the economic circumstances that determine flows into and out of the fund, and beliefs about the behavior of security markets. Once a passive portfolio is determined, deviations from that passive portfolio—active management—can be examined. AS a general rule deriving from modern portfolio strategy, the more the fiduciary chooses to vary from the passive portfolio strategy, the more evidence is needed of ability and economic rationale.

To illustrate this, concentrate for a moment on the common stock portion of a portfolio and assume that there are no special attributes of the fiduciary and that the standard CAPM is accepted as a reasonable model for describing excepted returns so that a widely diversified (market) portfolio of common stocks is appropriate. If the fiduciary decides simply to hire one manager to hold an index fund of common stocks, the decision becomes very simple. Expertise in running index funds at a low management fee is all that is required. Even here some discretion is called for. Different managers attempt to approximate the market portfolio in different ways (e.g., by holding a smaller number of stocks than is contained in the market portfolio), the idea being to decrease transaction costs while nearly replicating the market portfolio. In selecting such a manager, the fiduciary needs to know how the manager intends to replicate the market portfolio and to see that manager's track record of how well this has been done. In addition, the fiduciary needs to examine transaction costs. The final choice among alternative managers involves the tradeoff between one performance attribute (how well the portfolio traces the market portfolio) and two sets of costs (management fees and transaction costs within the portfolio).

What about the fiduciary who decides to deviate from the passive strategy? At the very least, the fiduciary needs some evidence that:

1. The investment strategy to be followed by the manager is consistent with the tenets of modern portfolio theory.

2. The manager has, in fact, followed the strategy he or she professes to follow.

3. The manager's past performance has been successful.

4. The costs of deviating from a passive strategy are reasonably expected to be more than met by gains.

In addition, the manager's performance must be continually tracked once hired to ensure that the above outlined points are met.

A few examples of how these rules might apply should be examined. Assume that a pension fund fiduciary selects a manager who specializes in constructing a portfolio of high technology stocks. There are two extreme cases to consider: first, where the fiduciary gives the manager all funds that are intended to be invested in equities, and second, where the high technology manager is given only the amount of funds that under the passive portfolio would be invested in high technology stocks. Start with the latter case. There is beginning to be some evidence in the literature of financial economics that analysts can outperform random selection. However, in hiring a manager for the high technology sector of the portfolio, the fund sponsor should require evidence that the manager hired can outperform random selection. In this case, the evidence should first take the form of examining the process used by the manager to select stocks. What special skills does the manager profess to have that allows the manager to pick the winners? Is it superior technological knowledge of the industries and the process involved, superior of the market place for new products, or something else? The fiduciary should then attempt to see if the manager actually has these special skills (e.g., does the staff the qualifications necessary to implement the strategy). Next the fiduciary should look at the historical record of the manager. Has this manager been successful in managing portfolios of this type in the past? Here it is important to measure the manger against the appropriate benchmark. For a manager of high technology stocks the appropriate is the population of high technology stocks, not

the S&P 500. If a wider group of stocks is used as a benchmark, the high technology stock might not look good (or poor) over a period of yeas because high technology stock did well (or poorly) over those years. If the manager is hired to replicate the high technology component of a passive portfolio, the relevant question is whether the manager out performed that component

Finally, if the manager outperforms a passive component, the fiduciary must ensure that the extra performance was sufficient to compensate for the extra diversifiable risk that was involved, that extra transaction costs involved in actively managing segment of the portfolio, and the management fee that would have to be paid.

If the manager is hired, performance must be monitored over time. The more the manager deviated from the high technology component of the passive portfolio, the more closely he or she should be monitored. If the manager does not deviate from the high technology component of the massive portfolio, the management should be questioned. The fiduciary is paying an active management fee. If all the fiduciary is getting passive management. Then too much is being paid for service.

If the fiduciary is getting active management, then underpreforming the high technology portions of the passive portfolio over a short to intermediate period of time form one the three years, is not necessarily evidence of poor management. Engaging in any active management usually results in increased risk over a passive strategy. This means the bad outcomes can occur. If they did not, the strategy would not be riskier. What must be monitored is weather the manager is following the strategy purported to follow and whether the manager maintained the ability to follow that strategy. While the question of capacity should always be tracked along with performance, obviously the longer period of inferior performance, the closer should be the scrutiny of the manager.

What about the cause where all common stock funds are given to the active high technology stock manager for investment? In this cause a greater burden of showing prudence is place on fiduciary. Placing all funds in one sector or type of stock means that the manager bears a large amount of diversifiable risk, for which there is no

compensation paid. To bear such risks requires solid reasons why a commensurate increase in return can be expected. While this is not that same as the case of holding a single asset discussed earlier, it is somewhat analogous. A portfolio concentrated in one sector of the market is likely to lie below the efficient frontier because it is not well diversified. If all assets are placed in such a nondiversified portfolio, strong evidence of and ability to produce superior performance must be produced.

Look at another case of active management, the case of a dividend rollover scheme (buy before a stock goes ex-dividend and sell afterward) offered to a tax-free Institution. It is well documented that the price of a stock should and does fall by less than the amount of the dividend when the stock goes ex-dividend. Tax-free institutions are theoretically n a position to take advantage of this phenomenon. In fact, in the absence of transaction costs, this would clearly be profitable strategy go a tax-free or a low-tax institution to follow. Theory would seem to be on the side of this strategy. However, a moment's reflection quickly reveals that at least in part, off setting the gain from the tax-dividend behavior of common stocks is the high turnover and thus the large amount of transaction costs that are incurred. Here the key question becomes whether or not the ex-dividend gain is sufficient to offset the transaction cost of getting into and out the stocks. The sponsor considering such a strategy should require:

1. Evidence as to the size of the ex-dividend drop in price relative to the dividend

2. Evidence as to the level of transaction costs that have been incurred on accounts like this.

3. An exact specification of the trading rule that will be used.

4. Evidence of past performance of the trading rule on the other accounts similarly managed.

If the technique appears promising given its past performance and fiduciary commits funds to a manager to carry out the technique, the fiduciary must be careful funds to a manager to carry out the technique, the fid must be careful to monitor performances. Once again, over a short period, the rule may not work well. For example, in a period when the stock market is going down, it would not be expected to work well at all.

Similar arguments can be made with any deviations from passive portfolio. The more extreme the deviation, the more cogent must be the arguments for following it (both in terms of theory and empirical evidence), and the more closely the implementation of strategy and performance must be monitored.

Actually, the previous discussion applies equally well to a fiduciary hiring an active manager or to a fiduciary actively managing all or part of the portfolio directly. One more lesson should be mentioned for the fiduciary who hires several managers. It is the fiduciary's obligation to monitor the entire portfolio (the sum of all managers' portfolios) to make sure that active management fees are not of being paid for passive management. To the extent that the actions of individual managers are not coordinated they can cancel each other out, with the total portfolio coming to resemble an index fund, albeit and index fund on which large active fees are paid.

H. Conclusions

This essay has reviewed several alternative theories of asset pricing, each of which has a significant number of adherents in the financial community and also a healthy number of detractors. There are certain lessons for the fiduciary, however, that are shared by all of these theories and therefore survive as widely accepted tenets of modern portfolio theory. It seems appropriate to review them here:

1. Diversification pays.

   All of the modern theories of portfolio analysis and capital asset pricing stress the need for diversification both across and within different types of assets. While moving away from the concept of the market portfolio, the point must be stressed that even with special characteristics or special knowledge the portfolio held should be widely diversified.

   Equilibrium theory suggests that all types of assets should be represented in a portfolio. While it is necessary to be careful of non-traded assets and the transaction costs associated with them, all assets should be considered as appropriate candidates for a portfolio.

2. Special characteristics or knowledge can justify tilting the widely diversified portfolio in certain directions.

For example, a pension fund whose inflow depends on the fortunes of the steel industry should tilt away from assets whose returns are positively correlated with the performance of the steel industry. As a second example, tax-free funds generally should not tilt against high-income securities. The exception to this would be if the investment manager had special ability to invest in the securities of the type that should be underinvested in, and this special ability was not transferable.

A well-founded belief in the ability to select undervalued securities or types of assets should lead to a diversified portfolio tilted in favor of these securities or types of assets.

3. The more tilting that is done, the greater the burden of proof on the fiduciary.

The greater the tilting, the more nondiversifiable risk is added. In addition, greater tilting requires added transaction costs. The expected payoff must be large enough to compensate for bearing nondiversifiable risk and for added transaction costs and management fees. Satisfactory evidence must be offered in terms of economic rationale and empirical evidence that the additional risk and costs are justified.

4. The risk of buying an asset or continuing to hold an asset can only be judged in terms of the impact of that asset on the portfolio.

5. The only way to increase the return of an efficient portfolio is to increase its risk. A manager must be judged in terms of both the risk and the return. Placing total emphasis on risk would force all managers to hold the risk-free asset and to give up returns.

6. Selecting a risky portfolio often means poor performance on a yearly basis. Common stock has historically outperformed bonds on a long-term basis. However, the odds are substantial that in any one year returns on common stock will be negative.

7. Short selling and borrowing should not necessarily be considered improper. While both can be used to take extreme risk positions, they can equally well be used to increase the risk-return opportunities available to the fiduciary.

8. Do not invest in dominated securities or portfolios. There are several types of securities or portfolios that are dominated. Corporate bonds or bank obligations may yield less than government bonds of similar maturity. Portfolios that have higher risk for the same return or other portfolios should also be avoided.

Risk depends on the investor's horizon. A ten-year pure discount instrument is risky for a one-year holding period but riskless in terms of meetings a known obligation at the end of ten years.

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