Designing Modern Equity Portfolios

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2011

Working paper nº 74/2011

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WORKING PAPER Nº 74/2011

Maio 2011

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Abstract

This aim of this paper is to describe possible ways of investing in equity; choosing the right stocks(among small-cap, large-cap, value, growth, and foreign) using fundamental analysis, defining their appropriate mix in the portfolios according to the desired return-risk profiles based on Markowitz's modern portfolio theory, and using technical analysis to buy and sell them.

Keywords: Modern portfolio theory, capital asset pricing model, choosing stocks, technical analysis

Introduction

The key to successful investing in equity is choosing the right stocks, and defining their appropriate mix in the portfolio to match the return-risk profile of a particular investor. The care taken in designing the right investment portfolio cannot protect investors from economic downturns like the 2008 financial crisis, but it can reduce eventual losses. Careful design will avoid asset allocation that can make or break an investment portfolio. The objective is not to make the investors suddenly rich, but to ensure that they accumulate wealth systematically over time.

By taking risks, it is possible to grow wealth much faster through investing in individual assets. Unfortunately, only a very few of those investors that bet everything on a single idea or information are successful. Most investors do not want to gamble. They want to generate higher wealth, but they also want to keep risk under control. This tradeoff between return and risk is central to a successful investment portfolio design. It is important to note that this is a genuine tradeoff. There is no return without taking risks.

This aim of this paper is to describe possible ways of investing in equity by choosing the right stocks, using modern portfolio theory to make the tradeoff between return and risk as attractive as possible to investors according to their particular risk profile, and employing technical analysis to buy and sell stocks. Two risk profiles are considered in the paper. The first profile is of a younger investor who wants to build wealth over time and is willing to take higher risks. The second is the profile of an older investor nearing retirement, who is more conservative in taking risks and wants to make sure that no unreasonable losses occur to his or her investments.

The concept of maximizing returns for any given level of risk is based on the pioneering work of Markowitz (1952). Using Markowitz's concept, investors can form equity portfolios that maximize returns for given levels of acceptable risk, or minimize risk for a desired return. However, to do this, investors need well-formulated estimates of asset returns, their risks, and the correlation to other assets. For this reason, this paper starts by defining return, risk, and correlation of assets.

Return, Risk, and Correlation of Assets

The best measure of long-term historical returns on an asset is the compound (geometric) average (G(r)) of the return (r_j) in any given period, defined by

$$(1+G(r))=[(1+r_1)(1+r_2)\dots(1+r_T)]^{1/T}$$

where T is the number of periods in the sample. The best estimate of the next period's return is the arithmetic average (A(r)) of the historical returns (r_j), defined by

$$A(r) = \Sigma_j r_j / T$$

The average real return (R(r)) considering the compound average inflation (π) is defined using a compound formula as

$$R(r) = (1+r_G)/(1+\pi) - 1$$

Note that both the compound (geometric) average rate of return (G(r)) and the arithmetic average rate of return (A(r)) are averages of periodic percentage returns. Neither will accurately translate to the actual dollar amounts gained or lost if percent gains are averaged with percent losses.

When the assets are stocks, analysts calculate their return (r_t) in any given year (t) as the dividend yield (D_t) plus the capital gain for this year(capital gain is the difference between the stock price at the end of the year P_t minus the stock price at the end of the previous year P_{t-1}) as

$$r_t = D_t / P_{t-1} + (P_t - P_{t-1}) / P_{t-1}$$

Because capital gain (P_t-P_{t-1}) used to calculate stock returns (r_t) is influenced by changes in the price-to-earnings ratio (P/E) for the stocks (reflecting changes in investors demand for the stocks), past returns are not a good basis to predict future expectations on stocks. For this reason, experts use more fundamental measures of corporate performance to predict future returns.

Fama and French (2002) proposed a way to estimate future return on stocks that reflect the rise in P/Es during the sample period by inflating the estimates of the future returns on the stocks. The proposed method measures the arithmetic average return (A(r)) over the number of periods in the sample(T) as

$$A(r) = \Sigma_j(D_t / P_{t-1}) / T + \Sigma_j[(P_t-P_{t-1}) / P_{t-1}] / T$$

where $GD_t = D_t / P_{t-1}$ is the growth rate of dividends and $GP_t = (P_t-P_{t-1}) / P_{t-1}$ is the growth rate of capital gains.

There are two measures of risk for assets. The first measure of the risk of an asset (x) is the standard deviation (σ_x) of the asset's returns, and is measured as the total variability of these returns by the square root of the variance (σ_x^2) as

$$\sigma_x^2 = (1/t)\Sigma_j(r_j-r)^2$$

The equation shows how much variation or "dispersion" there is from the arithmetic average return (r_A). A low standard deviation indicates that the returns (r_j) tend to be very close to the arithmetic average return (r_A), whereas high standard deviation indicates that the returns (r_j) are spread out over a large range of values.

The second measure of the risk of an asset (x)) relative to the market benchmark is Beta (β_x), defined as

$$\beta_x = Cov(r_x,r_M)/\sigma_M^2$$

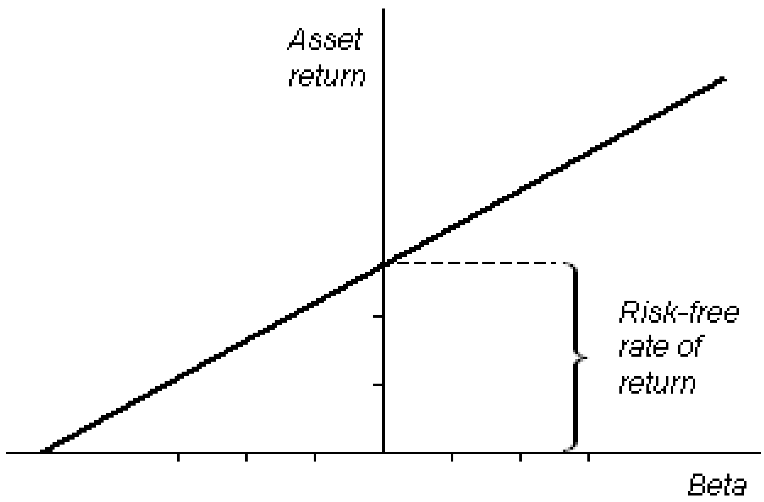
where $Cov(r_x,r_M)$ is the covariance between the return on the asset (r_x) and the return on the market (r_M), and (σ_M) is the standard deviation of the market. A zero Beta ($\beta_x = 0$), means that the asset's return (r_x) changes independently of the changes in the market's returns (r_M). A positive Beta ($\beta_x > 0$) means that the asset's returns (r_x) generally follow the market's returns (r_M), which means that both tend to be above their respective averages together, or both tend to be below their respective averages together. A negative Beta ($\beta_x < 0$) means that the asset's returns (r_x) generally move opposite the market's returns (r_M), which means that one will tend to be above its average when the other is below its average.

The capital asset pricing model (CAPM) was introduced to determine a theoretically appropriate rate of return of an asset (x) to be added to a well-diversified portfolio, given the assets' risk relative to the market benchmark (β_x) as

$$E(r_x) = r_F + \beta_x (E(r_M) - r_F)$$

where $E(r_x)$ is the expected rate of return, r_f is the risk-free return, β_x is Beta of asset x, and $E(r_M)$ is the expected rate of return of the market (Fama and French, 1996, 2004). The relationship between β_x and required return for asset x is plotted on the securities market line (SML) which shows expected return as a function of β_x (Figure 1). The SML graphs the results from the CAPM. The intercept between the axis that represents the risk Beta (β_x) and the axis that represents the expected return $E(r_x)$ is the nominal risk-free rate available for the market, while the slope is the market risk premium ($E(r_M) - r_F$).

Figure 1. The Security Market Line (SML), seen here in a graph, describes a relation between the beta and the asset's expected rate of return



Source: Wikipedia (http://en.wikipedia.org/wiki/File:SecMktLine.png)

The expected or required rate of return for an asset x ($E(r_x)$) suggested by the CAPM, is used to benchmark the estimated rate of return ($E_c(r_x)$) of the asset x, calculated by fundamental or technical analysis over a specific investment horizon (T periods) to evaluate if the investment in the asset is appropriate. The asset x is correctly priced when its price (P_x) is the same as the present value of future cash flows of the asset (PV_{xT}), discounted at the rate suggested by CAPM. If the price is higher than the present value (PV_{xT}), the price (P_x) is overvalued; and when price (P_x) is lower than the present value (PV_{xT}), it is undervalued.

The Sharpe ratio (S_x) is the measure of the excess return (or risk premium) per unit of risk in an investment asset (x), and is defined as

$$S_x = (r_x - r_F) / \sigma_x$$

where r_x is the arithmetic average return of asset x, σ_x is the standard deviation of asset x, and r_F is the return on risk-free assets (Sharpe, 1966; and Scholz, 2007). The Sharpe ratio defines the compensation for the risk taken. The higher Sharpe ratio number is um so better is the compensation for a given risk. When comparing two portfolios with the same expected arithmetic return (r), the one with the higher Sharpe ratio yields a better return for the same risk.

Jensen's Alpha, or simply Alpha (α_x), measures the excess return on an asset (x), relative to the arithmetic average return on the market benchmark ($A(r_M)$) as

$$\alpha_x = A(r_x) - [A(r_F) + \beta_x (A(r_M) - A(r_F))]$$

where $A(r_x)$ is the arithmetic average return on asset x, β_x is the Beta of asset x, and $A(r_F)$ is the arithmetic average return on risk-free assets (Jensen, 1968; and Chincarini and Kim, 2006). The expression

$$A(r_F) + \beta_x (A(r_M) - A(r_F))$$

is the arithmetic average return on the market benchmark adjusted for the Beta of asset x, and Alpha (α_x) is the return above or below the market at the same level of risk as asset x.

To measure the performance of a portfolio (P), rather than an individual asset, a different excess measure is used. The excess return must be measured in the standard deviation space (σ) rather than in the Beta space (β). Because most portfolios have less risk than the market as a whole, it is important to compare returns at a common level of risk. Alpha-Star (α_P*) brings the risk level of the market down to that of the portfolio (P) to be evaluated (Marston, 2011). The expression for Alpha-Star (α_P*) shows how this is done:

$$\alpha_P* = A(r_P) - [A(r_F) + (\sigma_P/\sigma_M)(A(r_M) - A(r_F)]$$

where $A(r_P)$ is the arithmetic average return on the portfolio, and σ_P is the standard deviation of the portfolio. Note that Alpha-Star does not give any more information about risk-adjusted returns than that which is provided by the Sharpe ratio, but it translates differences in Sharpe ration into excess returns that can be better understood by investors (Marston, 2011).

Many academics believe that financial markets are too efficient to allow for portfolios to repeatedly earning positive Alpha-Star, unless by chance (Fama & French, 2002). This may explain why passive investing in exchange-traded funds (ETF) has become so popular with investors (Ferri, 2008).

The fundamental concept behind Markowitz's (1952, 1991) theory (known today as modern portfolio theory) is that individual assets that form an investment portfolio should not be selected exclusively on their own merits—return and risk. They should be selected considering also how their return changes relative to how the returns of all other assets in the portfolio change. The assets are more correlated the more their return changes coincide in the same direction; less correlated in the proportion that their returns changes are different; and negatively correlated when their returns changes are in opposite directions.

The merit of the correlation ($-1 \leq \rho \leq 1$) between assets in a portfolio can be seen intuitively in the case of two different types of assets (x and y) that change returns over time in opposite ways. Because the returns of these assets have a negative correlation ($\rho < 0$) between them, a portfolio composed by portions of these assets is less risky than the individual assets. The diversification into different types of assets lowers risk, even if the assets' returns are not negatively correlated. Indeed, the risk is lower even if they are positively correlated ($\rho > 0$).

Modern Portfolio Theory

Modern portfolio theory (MPT) is a theory of investment, based on the concept pioneered by Markowitz (1952, 1991). MPT is an attempt to maximize the expected return for a portfolio of assets at a given level of risk, or minimize its risk for a given level of expected return by carefully selecting assets and choosing the proportions of various assets in the portfolio.

The mathematical formulation of the MPT concept aims at selecting a correlation (ρ) of diversified assets that collectively have a lower risk than the individual assets in the portfolio. The equation starts by modeling the return of each asset (r) as a normally distributed function, defining risk as the standard deviation (σ) of the return for the asset, and using the portfolio as the weighted combination of the individual assets' returns. By combining assets whose returns are not perfectly correlated in the portfolio, the investor reduces the total variance (σ^2) of the portfolio's return. Note that the basic assumption in MPT is that investors in the market are rational and that the market is efficient. This assumption in recent years has been widely challenged in fields such as behavioral finance.

The expected return of a portfolio $E(r_P)$ is calculated as the weighted (w_k) expected return $E(r_k)$ of each individual asset (k) as

$$E(r_p) = \Sigma_k w_k\ E(r_k)$$

where the weight w_k is the share of asset k in the portfolio. The total variance ($\sigma_P{}^2$) of the portfolio is calculated as

$$\sigma_p{}^2 = \Sigma_k\ w_k{}^2\sigma_k{}^2 + \Sigma_k\Sigma_{x\neq k}w_k w_x\sigma_k\sigma_x\rho_{kx}$$

where ρ_{kx} is the correlation coefficient between assets k and assets x. An alternative way to write this equation is

$$\sigma_p{}^2 = \Sigma_k\Sigma_x w_k w_x\sigma_k\sigma_x\rho_{kx}$$

where $\rho_{kx} = 1$ for $k = x$. The standard deviation (σ_p) of the portfolio calculated as

$$\sigma_p = \sqrt{\ }\ \sigma_p{}^2$$

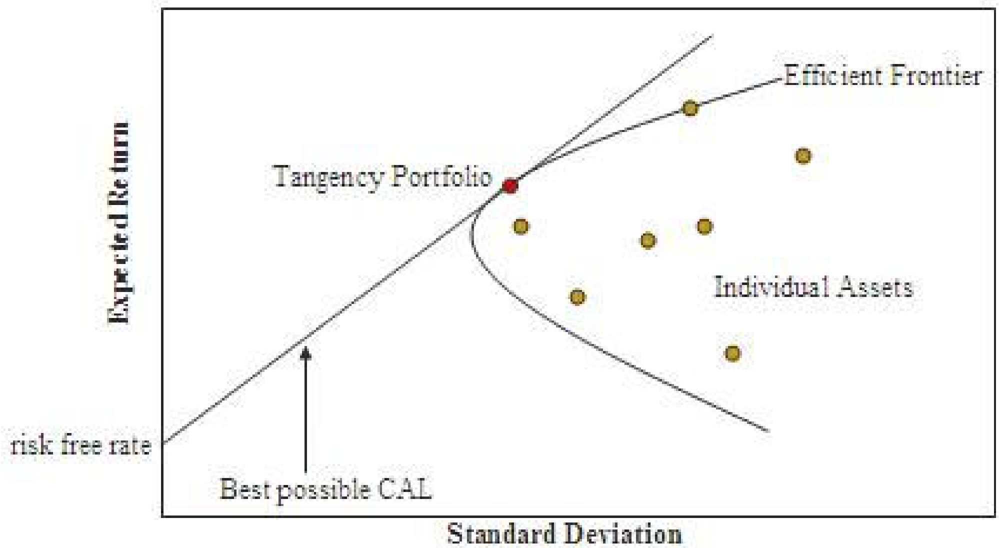
and represents the risk (or volatility) of the portfolio.

Note that the MPT is a model of the financial markets that does not match the real world in many ways. Some of the assumptions underlying the MPT model about markets and investors are questioned by critics (Taleb, 2007). Some of these assumptions are explicit in the equations like the normal distribution model of returns, in that the correlation between is fixed and constant forever, and there are no taxes and transaction costs. Others, like the efficient market hypothesis that assumes all investors aim to maximize their economic return, are rational and risk-averse, have access to the same information at the same time, have an accurate conception of possible returns, are price takers, and their probability belief matches the true distribution of returns (Daniel, Hirshleifer, & Subrahmanyam, 2001).

Portfolio Efficient Frontier

We can calculate for a portfolio every possible combination of specific risky assets (without including any risk-free assets) and plot for each combination the expected return and the associated risk in a space where the vertical axis displays the return and the horizontal axis the risk (Figure 2). The collections of all these possible combinations of risky assets in the portfolio are represented by points in this space. The left boundary of the plotted points in the space is a hyperbola sometimes called the "Markowitz bullet" (Haugen and Baker, 1990).

Figure 2. Efficient Frontier. The hyperbola is sometimes referred to as the "Markowitz Bullet," and is the efficient frontier if no risk-free asset is available. With a risk-free asset, the straight line is the efficient frontier



Source: Wikipedia (http://en.wikipedia.org/wiki/File:Markowitz_frontier.jpg)

The upper edge of the hyperbola is the efficient frontier for the portfolio without risk-free assets. The combination of the specific risky assets in the portfolio plotted on the efficient frontier represents the lowest risk possible for the portfolio for a desired level of expected return, or the best possible expected return for an acceptable risk level.

The inclusion of risk-free assets in the portfolio (such as US treasury bills considered to have zero variance in returns, and are uncorrelated to any other asset) transform the efficient frontier into a straight half-line called the capital allocation line (CAL) in Figure 2 (Haugen and Baker, 1990). We can calculate the CAL as

$$E(r_C) = r_F + \sigma_C\,[(E(r_{TP}) - r_F) / \sigma_{TP}]$$

where $E(r_C)$is the expected return of the combined portfolio (C) with an amount of risk-free assets with an amount of the tangency portfolio (TP), $E(r_{TP)}$ is the expected return of the tangency portfolio (TP) with a specific combination of risky assets, r_F is the return on risk-free assets, σ_C is the standard deviation of the combined portfolio (C), and σ_{TP} is the standard deviation of the tangency portfolio (TP).

The point that the CAL tangents the hyperbola of the efficiency frontier of the portfolio with a specific composition of risky assets is called the tangency portfolio (TP) with the highest Sharpe ratio (S_{TP}) defined as

$$S_{TP} = (A(r_{TP}) - A(r_F)) / \sigma_{TP}$$

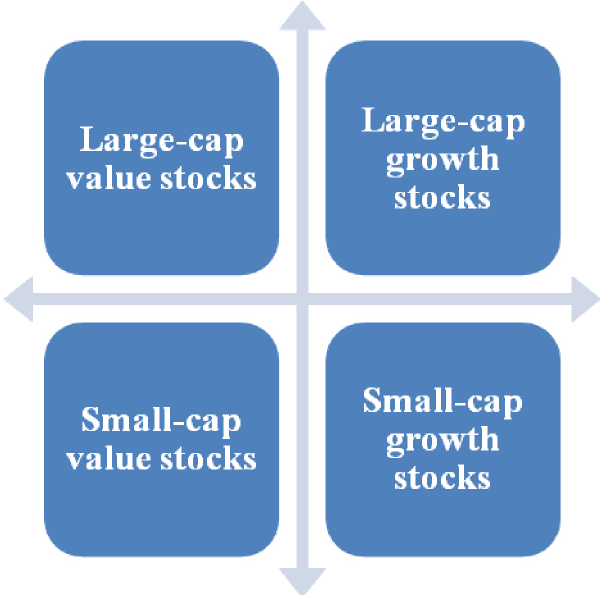
Points on the CAL between the return of risk free assets and the point of the tangency portfolio (TP) are combination portfolios (C) containing amounts of risk-free assets and amounts of the tangency portfolio. Points on the CAL beyond the tangency point are leveraged combination portfolios (LC) because they involve short holdings of risk-free assets. This means that the investor borrowed an amount at the risk-free rate and invested it in the tangency portfolio.

Choosing Stocks

The design of an investment portfolio starts with choosing the right stocks. Every investor would like to find the right stocks with superior returns that will outperform the market. For this purpose, they can evaluate earnings, dividends, cash flows, book values, capitalizations, and past performances of companies to find the right stocks. However, according to the efficient market hypothesis (EMH), these evaluation criteria are already factored into the stock prices, and choosing stocks based on these fundamental factors will not improve the selection. This is because in efficient markets only higher risks will enable investors to receive higher returns. Note that although the EMH has become controversial (as mentioned before) because of observed inefficiencies, it is still the most-used hypothesis and the basis of MPT (Rosemberg, Reid, & Lanstein, 1985).

The Beta (β) of a stock estimated from historical data represents the fundamental risk of a stock's return for which investors must be compensated. If Beta is greater than one ($\beta > 1$), the stock requires a return greater than the market, and if Beta is less than one ($\beta < 1$), a lesser return is required. Unfortunately, Fama and French (1992) found that there are two factors, one relating to the size of the stocks and the other to the valuation of the stocks that were far more important in determining a stock's return that Beta. This prompted market analysts to classify the stocks along these two dimensions: size, as measured by the market value of the stock (small-cap and large-cap stocks); and valuation, measured in relation to fundamentals such as price-to-book, price-to-earnings ratio (P/E) and dividends (value and growth stocks). As a consequence, many analysts divided portfolios into four quadrants, called style boxes (Figure 3), which show large-cap value and growth, and small-cap value and growth (Marston, 2011).

Figure 3. Style boxes along two dimensions market value of stocks and valuation of stocks



Source: R. Marston, (2011), *Portfolio Design: A Modern Approach to Asset Allocation*, p. 57.

In the next two sections, recent evidence for the premium of small-cap stocks over large-cap stocks and of value stocks over growth stocks will be examined.

Small-Cap and Large-Cap Stocks

The stocks listed at the New York Stock Exchange (NYSE) range in value from a few million to more than hundreds of billions dollars. These stocks are divided according to their value into 10 deciles by the Center for Research in Security Prices (CRSP) at the Graduate School of Business of the University of Chicago. The deciles are defined by using NYSE stocks only, but stocks from NASDAQ and the American Stock Exchange (AMEX) are included in the 2010 Ibbotson SBBI Classic Yearbook (Morningstar, 2011). In the 2010 Yearbook, the top decile included only 168 stocks, but they represent more than 63% of the total market capitalization of the three stock exchanges. The top three deciles include only 518 stocks, but represent more that 83% of the total market capitalization. On the other hand, the lower two deciles contain more than 1,900 stocks and represent only less than 2.5% of the market capitalization (Marston, 2011).

The first author to document the relationship between the market-cap of a stock and its return was Banz (1981). He not only demonstrated that returns on small-cap stocks are higher than on large-cap stocks, but he also showed that small-cap stocks have an abnormal excess return when measured against the security market line (SML) of the capital asset pricing model (CAPM). Another curious feature documented by Keim (1983) is that most of the small-cap premium occurs in the month of January. He showed that more than 50% of any small-cap premium is due to the January return and that 50% is achieved in the first week of January trading.

According to Marston (2011), the small-cap premium seems to have diminished since the research on small caps peaked in the early 1980s. To demonstrate this, he calculated the average arithmetic return on small-caps and large-caps using the SBBI series as shown in Table 1. From 1951 to 1980, the average excess return on small-caps was 0.375% per month or 4.50% annualized. From 1981 to 2009, this excess return falls to 0.138% per month or 1.65% annualized. The same happened to the January premium (defined as the excess return of January relative to the average monthly return of the other 11 months of the year) as shown in Table 1.

Table 1: Evidence of Small-Cap Premium

Arithmetic average in percent per month	1951-1980	1981-2009
Small-cap stocks premium over large-cap stocks	0.375%	0.138%
Small-cap premium in January alone	5.270%	1.740%
Small-cap January return over average return for the rest of year	5.900%	1.880%

Source: R. Marston, (2011), *Portfolio Design: A Modern Approach to Asset Allocation*, p. 42.

Marston (2011) pointed out that small-cap stocks represent less than 10% of the market capitalization of the stock market. Whether small-cap stocks should be allotted a higher proportion in a portfolio depends on their risk and return characteristic. Siegel (2008) warned investors that the existence of the small-cap stocks premium does not mean that they will outperform large-cap stocks every year, or even every decade.

Value and Growth Stocks

Fama and French (1992, 1993) demonstrated that there is also a premium that rewards investment in value stocks relative to growth stocks. Value stocks are normally defined as having a low price-to-book ratio and/or low price-to-earnings ratio. The value and growth stocks were compared by Marston (2011), using the Russell indexes started in 1979 (Russell Investment). The relative performance of these indexes were measured in three different ways: (a) average arithmetic returns (arithmetic A(r) and geometric G(r)), (b) returns adjusted for risk using standard deviation (σ), and (c) returns adjusted for systematic risk using Beta (β).

Table 2 presents the summary statistic for the Russell 1000 index for large-cap stocks from 1979 to 2009 divided into two indexes, one for growth stocks and the other for value stocks (Marston, 2011). The Russell 1000 value index (for large-cap value stocks) gives a substantially higher average return than the growth index (for large-cap growth stocks) over the period. This is true whether geometric average return (G(r)) or arithmetic average return (A(r)). The standard deviation (σ = 17.8%) for the large-cap growth stocks is much larger than that for large-cap value stocks (σ = 14.9%). This contradicts the expectation that stocks with higher risks should also have a higher returns. The lower Sharpe ratio (S = 0.34) for the large-cap growth stocks compared with large-cap value stocks (S = 0.47) also demonstrates that investors are not being compensated for the higher risk (σ = 17.8%) in large-cap growth stocks.

Table 2. Returns for Russell 1000 Large-Cap Growth and Large-Cap Value Stocks from 1979 to 2009

	Geometric average return	Arithmetic average return	Standard deviation	Sharpe ratio
Russell 1000 growth	10.5%	11.6%	17.8%	0.34
Russell 1000 value	12.1%	12.6%	14.9%	0.47

Source: R. Marston, (2011), *Portfolio Design: A Modern Approach to Asset Allocation*, p. 60

Similarly, Table 3 presents the summary statistics for the Russell 2000 index for small-cap stocks from 1979 to 2009 divided into two indexes, one for growth stocks and the other for value stocks (Marston, 2011). The conclusions for the small-cap stocks are similar as for the large-cap stocks.

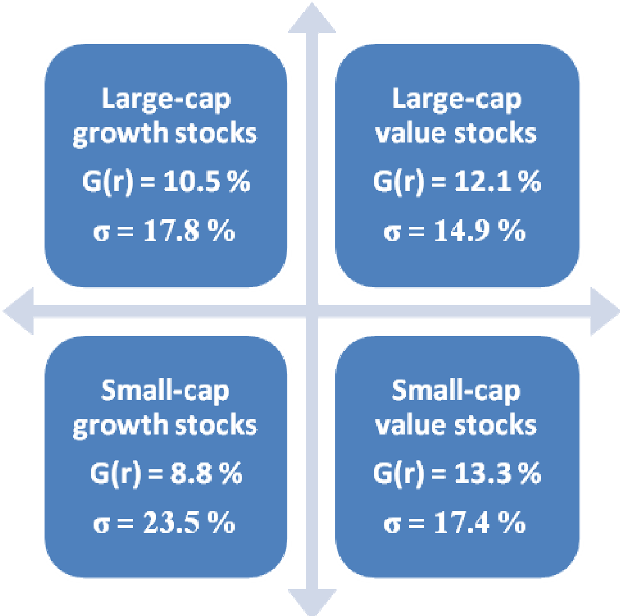
Table 3. Returns for Russell 2000 Small-Cap Growth and Small-Cap Value Stocks from 1979 to 2009

	Geometric average return	Arithmetic average return	Standard deviation	Sharpe ratio
Russell 2000 growth	08.8%	11.3%	13.5%	0.25
Russell 2000 value	13.3%	14.2%	17.4%	0.50

Source: R. Marston, (2011), *Portfolio Design: A Modern Approach to Asset Allocation*, p. 66

Comparing the geometric average returns (G(r)) of the large-cap stocks (Table 2) and small-cap stocks (Table 3), the poorest performance was that of the small-cap growth stocks with only 8.8% and the best performance was that of the small-cap value stocks with 13.3% (Figure 4). The standard deviation (σ = 17.4%) for small-cap value stocks is smaller than that for large-cap growth stocks (σ = 17.8%), and much smaller than that for small-cap growth stocks (σ = 23.5%). Only large-cap value stocks have a smaller standard deviation (σ = 14.9%). The Sharpe ratio (S = 0.25) for small-cap growth is much lower than for any other asset class. The lower Sharpe ratio (S = 0.25) clearly demonstrates—as in the case of large-cap growth stocks—that investors in small-cap growth stocks are not being compensated for the high risk (σ = 23.5%) in small-cap growth stocks.

Figure 4. Comparison Between Large-Cap Growth and Value Stocks with Small-Cap Growth and Value Stocks Performance Using Russell 1000 and 2000 Data Between 1979 and 2009



Source: Marston, 2011, *Portfolio Design: A modern Approach to Asset Allocation*, p. 68

Should Growth Stocks Be In a Portfolio?

Considering the conclusions of the comparison between growth and value stocks using the Russell 1000 and Russell 2000 indexes data over the period between 1979 to 2009 (Figure 4), Marston (2011) raised the question of whether growth stocks should be included in a portfolio. To answer this question, he built a portfolio of stocks and bonds with and without growth stocks and evaluated the differences in performance.

The growth and value portfolio was composed of 30% Russell 1000 value stocks, 30% Russell 1000 growth stocks, 5% Russell 2000 value stocks, 5% Russell 2000 growth stocks, and 30% Barclays Aggregate bonds. The value-only portfolio was composed of 60% Russell 1000 value stocks, 10% Russell 2000 value stocks, and 30% Barclays Aggregate bonds.

The arithmetic average return on the value-only portfolio was 0.4% higher than the growth and value portfolio with a standard deviation of 0.7% lower than the growth and value portfolio (Table 4). The Sharpe ratio for the growth and value portfolio (S = 0.48) is lower than that for the value-only portfolio (S = 0.54) which indicates that the value-only portfolio provides better compensation for the risk. This clearly demonstrates that the diversification into growth stocks does not compensate for the additional risk.

Table 4. Comparison Between Portfolios With and Without Growth Stocks

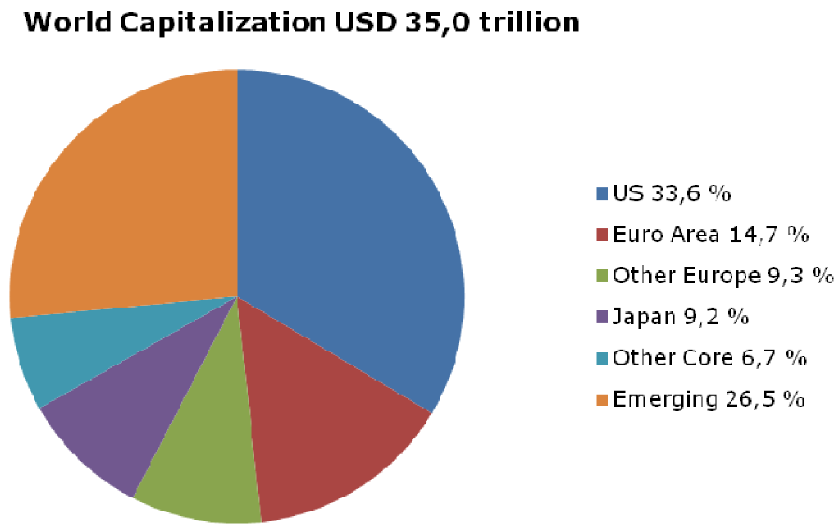
	Average arithmetic return	Standard deviation	Sharpe ratio
Growth and value portfolio	11.1%	11.7%	0.48
Value-only portfolio	11.5%	11.0%	0.54

Source: R. Marston, (2011), *Portfolio Design: A Modern Approach to Asset Allocation*, p. 69

Foreign Stocks for Diversification

The world stock market had a capitalization of $35 trillion in 2008 (Standard & Poor's [S&P], 2009). The US stock market had a share of 33.6% of the world market, other industrial countries had 39.9%, and the remaining 26.5% belonged to emerging markets (Figure 5).

Figure 5. World stock market capitalization of the major regions



Source: *S&P Global Stock Market Factbook*, 2009.

Foreign stocks deliver comparable returns to those of US stocks, but with wide variations in performance across regions of the world. This provides a strong incentive for portfolio diversification because of the low correlation between foreign and US stocks. However, due to the increasing integration of the world financial markets, the correlation has risen substantially since 1998 (Marston, 2011).

A simple way of investing in foreign stocks is investing in ADRs (American Depository Receipts) of these stocks at the NYSE. ADRs are closely aligned to the underlying foreign stock returns because of international arbitrage.

The other possibility of investing in stocks of US multinational firms that have extensive operations in foreign countries does not provide effective foreign diversification. This is because research has shown that the stocks of US multinationals are much more correlated with the US stock market than with foreign stock markets (Marston, 2011).

Choosing the Appropriate Mix of Stocks

Choosing the right stocks for a portfolio should be based on the fundamental analysis of the companies that involves analyzing its financial statements and health, its management and competitive advantage, and its competitors in the market. Luckily, there are many reports on companies with stocks traded on the main stock exchanges. These reports, made by investment analysts, are readily available, so that it is relatively easy to get good information on stocks' historical return, risk, and correlation to other stocks.

After choosing the stocks, it is important to validate the selections using technical analysis. Fundamental analysis focuses on the study of the performance of the companies and the supply and demand factors that determine the rationale for the price of the stocks. Technical analysis, on the other hand, focuses on the study of the market action, the effects, and the price movement itself. As a general rule, investment selection using analysis and investment timing are inversely important. When the investment horizon is longer, selection becomes more important than timing, although timing is far more critical when the horizon is shorter. It is when timing is critical that technical analysis is most valuable (Little & Rhodes, 2004).

The paradigm of technical analysis is the efficient-market hypothesis that states that all of the factors that influence market prices of stocks—fundamental analysis, political events, natural disasters, and psychological factors—are quickly transformed into market activity. This means that the impact of all these factors will quickly show up in some form of price movement. Some analysts even defend that technical analysis is simply a short-cut form of fundamental analysis (Murphy, 2000).

It is also important that a portfolio be composed of as many stocks as possible (for an investor to reasonably manage) to reduce the risk of any individual stock in the portfolio. The stocks should also preferably come from many uncorrelated industries so to reduce the specific industry risks in the portfolio.

The next step is to employ a linear optimization software using the MPT formulas to calculate the expected return ($E(r_p)$) and total variance (σ_p^2) of the possible combination of weights (w_k) of each selected stock (k) in the portfolio. The result will be the portfolio's efficient frontier (Figure 2) that represents the combinations of weight of the selected stocks that give the best expected return ($E(r_p)$) for each level of risk (σ_p) or the least risk for each desired level of return.

If the portfolio is composed only of stocks (risky assets), the overall risk of the portfolio is higher. This type of portfolio is better suited for younger investors who want to build wealth over time and are willing to take the higher risk. For older investors nearing retirement who want a lower risk, the solution is to include risk-free or low-risk assets (such as US treasury bills and bonds) in the portfolio. The efficiency frontier for this type of portfolio is the capital allocation line (CAL in Figure 2). The risk of the portfolio decreases linearly as the weight of the risk-free assets in the portfolio is increased along the CAL. With the decrease in risk, the return also decreases linearly.

Buying and Selling Stocks

The last step after choosing the stocks and determining the weight of each individual stock in the portfolio is buying the stocks at the right moment. It is important to use technical analysis to determine the best market timing for the buying of each individual stock. The stocks are selected for the portfolio based on their expected long-term average return. However, they normally fluctuate randomly around the average trend line and investors should avoid buying at the high price peak. Ideally, investors should buy in a low-price peak.

Because the stock market is dynamic and price shifts of stocks occur over time, influenced by many factors, the timing for buying and selling of each stock based on technical analysis are indispensable aspects of managing an investment portfolio. Technical analysis allows investors to detect long-term trend reversals in the prices of stocks in time to determine the best timing for buying and selling them.

Conclusion

Designing a modern equity portfolio requires the use of fundamental analysis, validated by technical analysis, to choose the right stocks based on their return, risk, and correlation to other stocks. It is important to choose enough stocks to minimize the individual risk of each one in the portfolio and to diversify into as many uncorrelated industries and countries as possible. After selecting the stocks, the investor has to use linear optimization software to calculate (using the MPT formulas) the weight of each stock in the portfolio to get the lowest possible risk for a desired return, or the best possible return for acceptable risk level. For investors who want a lower risk, the solution is to include risk-free or low-risk assets (such as US treasury bills and bonds) in the portfolio. The last step is to use technical analysis to time the buying and selling of each stock and watch the market trends.

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