Basic Concepts of Portfolio Design: Performance/Risk/Behavior

Few subjects inspire more discussion than investments, much of which should be dismissed as hype. Despite much of the meaningless chatter, there is a core of investment practice, which is well established and reasonably scientific. We live in a time of paradox with respect to investing standards. On the one hand, breakthroughs in the analysis of investment behavior - known as Modern Portfolio Theory - have literally revolutionized the mainstream perception of how investments work together. And on the other hand, many of the ancient superstitions and misunderstandings of investment behavior still influence the actions of investors.

Serious investors, and that includes all who are serious about enhancing the value of their savings over the long-term, should be aware of the established concepts of modern investing. We start with a short review of the basic concepts of modern investing practices.

Modern Portfolio Theory ("MPT") is a body of knowledge concerning investment analysis and portfolio management, which began in the 1930's. Since then, empirical research has been conducted at leading universities and the results debated in scholarly journals. The 1990 Nobel Prize in Economic Sciences was awarded to three financial economists, Harry Markowitz, Merton Miller and William Sharpe, for their work in developing MPT, much of which was done by them in the 1950's and 1960's.

The cornerstones of MPT are creditable and thoroughly documented, even though MPT's finer elements continue to be debated and modified. While there will always be competing theories about the behavior of investments which give conflicting signals, it is also true that consistent themes have been developed over the last fifty years about which there is general agreement.

Much of MPT involves the quantification of the behavior of a collection of investments ("a portfolio"). Many of the statistical concepts employed today for portfolio analysis find their genesis in MPT. Such frequently used terms as "total rate of return," "standard deviation," and "correlation" have really only been applied in the investment world for about the last 50 years. Here is a review of some of the most essential tools for measurement of investment portfolio behavior. The terms described below are just some of the most basic MPT statistical tools, but they certainly can assist us in understanding how MPT has revolutionized the investment world as we know it today.

Total Rate of Return = Performance

Total return is the widely accepted measurement of performance. Calculated by adding income (dividends, interest or net rental income) to the change in value of the investment asset. Total return is usually expressed as an annual percentage rate.

Example: On January 3, 1995, the common stock of Microsoft Corporation closed at 61- 1/2 and at 87-3/4 on December 31, 1995, but the stock paid no dividends. Microsoft's total return for 1995 was 42.68% computed as follows:

FIGURE 1
CALCULATING TOTAL RETURN

Microsoft's 1995 Performance

+ $0.00	income
+ $26.25	appreciation (gain)
- $0.00	depreciation (loss)
26.25	total return $
26.25	total return
+ 61.50	starting stock price
= 42.68%	Total rate of return

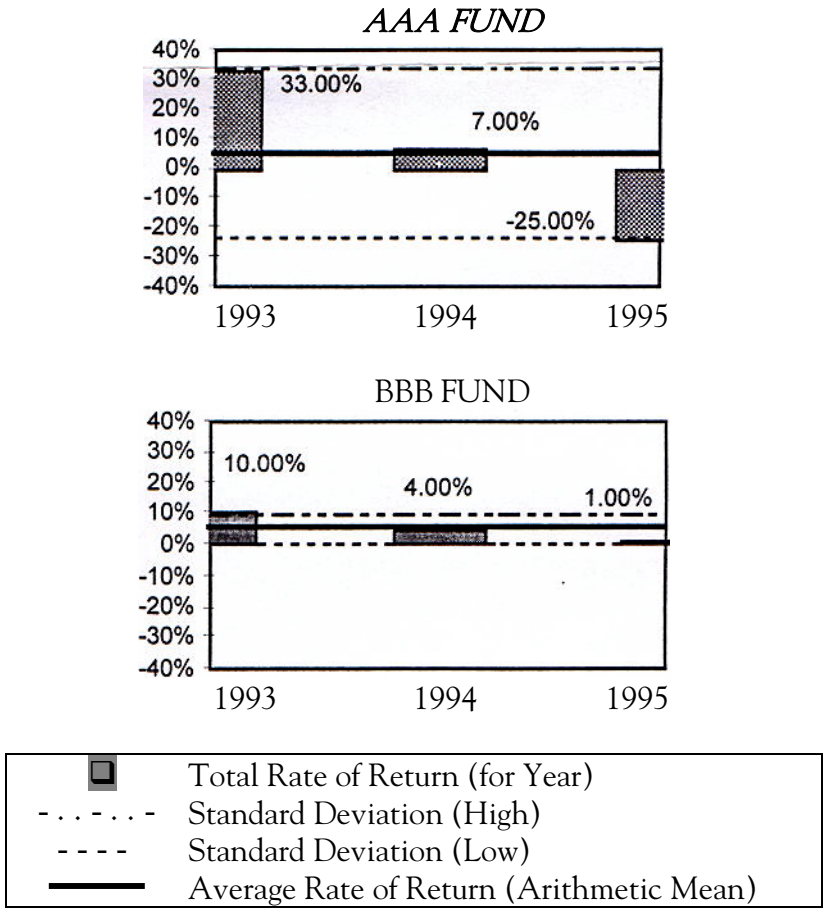
Significance: Total rate of return provides a common measurement for measuring performance of any type of investment. Prior to MPT, yield or income production was most often the measurement of performance. This contributed to a mindset favoring bonds and eschewing stocks which were viewed as having primarily speculative value.

Standard Deviation = Risk

Quantifies predictability and volatility, the fundamental measurement of risk for investments. Measures the variation of returns on either side of an average return. Like total return, standard deviation is expressed as a percentage rate.

Example: From 1993 through 1995, both AAA Fund and BBB Fund had average annual returns of 5%, but their annual performances varied substantially. It is clear from the chart that AAA Fund's returns were more volatile than BBB Fund's. This is reflected in their standard deviations which were about 29.5% for AAA and 4.5% for BBB. In other words, AAA was about seven times as volatile or "risky" as BBB which had the superior risk-adjusted performance.

FIGURES 2A and 2B
STANDARD DEVIATION ILLUSTRATIONS



Significance: Although an investment's average rate of return gives us the long-run average, which is significant and useful information in a simple and convenient form, it may leave out a lot of detail. In particular, it does not tell us whether the values comprising the average cluster closely around the average, in which case the average alone gives a fairly complete picture, or whether the values are widely scattered, in which case the information supplied by the average is less representative and therefore less useful. We use the statistical concept of "standard deviation" to measure the variability of returns by quantifying the dispersion of data from the mean. In simpler terms, it tells us how far (+ or -) we can stray from the average return and still be within the central 2/3 of all outcomes. The higher the standard deviation, the more scattered the results (and the risk of not achieving the average).

Correlation = Behavior

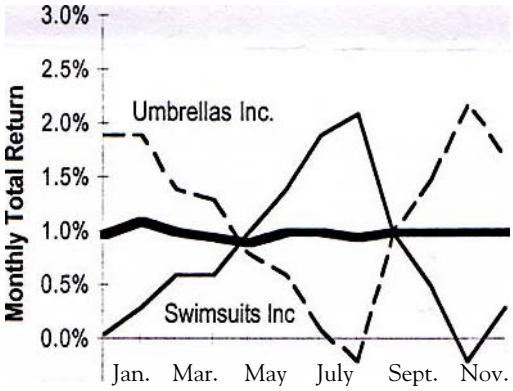
Quantifies how investments behave relative to one another. The degree to which two separate sets of data are linked is expressed on a scale of +1 to -1.

Examples: Positive correlation occurs when two investments perform similarly. For example, when A goes up 10%, B goes up 10%, and when B goes down 5%, A goes down 5% too — those investments are said to have a correlation coefficient of 1, or a high correlation.

Example: Negative correlation occurs when two investments perform in opposition. For example, A goes up 10%, B goes down 10% and when B goes down 5%, A goes up 5% — A and B are said to have a correlation coefficient of -1, or a low correlation.

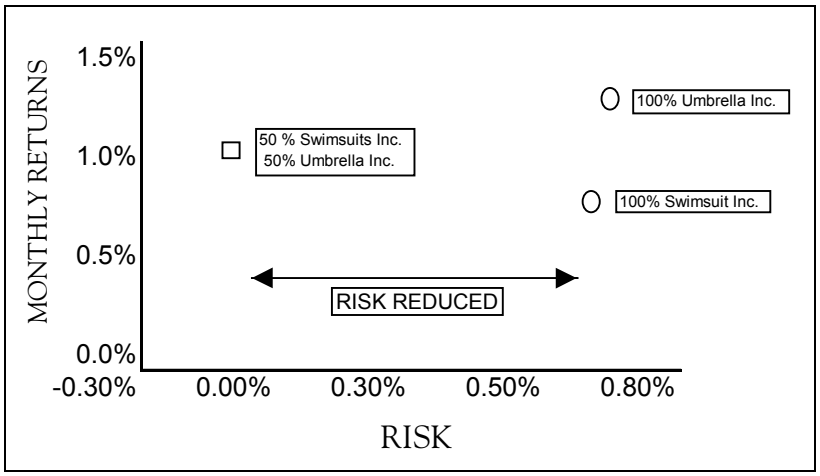
Example: In Figure 3, we see an imaginary example of two companies whose quarterly returns are negatively correlated: Seattle Swimsuits and Seattle Umbrellas. Please don't get too analytical here . . . to appreciate the example you will need to suspend your disbelief a bit and assume the total returns of the stocks simply follow the seasons. When the sun shines, swimsuits sell. When it rains, umbrellas sell. And the shareholder for the two companies ride a seasonal roller coaster based solely on quarterly sales.

FIGURE 3
NEGATIVELY CORRELATED INVESTMENTS
(SWIMSUITS AND UMBRELLAS)



In fact, Seattle Swimsuits and Seattle Umbrellas are close to absolute negatively correlated, which is to say they have a correlation coefficient of about –1.0. An investor who bought equal weightings of both companies would realize the same return as owning all of either company. At the same time, that investor would virtually eliminate the seasonal volatility associated with either company alone. Figure 4 shows all the same concept in a Cartesian-style chart in which risk increases to the right and return for a 50/50 weighting of the two companies is the average of the two companies' returns, while risk (standard deviation of return) is virtually eliminated.

FIGURE 4
NEGATIVE CORRELATIONS; RETURNS AND
RISK WEIGHTINGS



In figure 5 we turn to a real-life matrix of correlation coefficients for various asset classes. The ideal mixture of asset classes, assuming their expected rates of return are identical over a given time period, is composed of two classes which are as negatively correlated as possible. For example, using the matrix we can see that equity real estate investment trusts (REITs) correlate negatively with US Treasury Bills. It is interesting to note, however, that absolutely negatively correlated classes of assets appear not to exist in the real world.

For example, the lowest coefficient in the matrix is only slightly negative (Equity REITs and Treasury Bills have a correlation coefficient of –0.1)

FIGURE 5
SAMPLE ASSET CLASS CROSS-CORRELATION COEFFICIENTS

Sample Asset Class Cross-correlation Coefficients

	Treasury Bills	Corporate Bonds	Common Stocks	Small Stocks	Int'l Stocks	Int'l Bonds	Equity REITs
Treasury Bills	1.00						
Corporate Bonds	0.06	1.00					
Common Stocks	-0.09	0.35	1.00				
Small Stocks	-0.09	0.21	0.80	1.00			
Int'l Stocks	0.15	0.22	0.52	0.46	1.00		
Int'l Bonds	0.16	0.37	0.12	0.05	0.63	1.00	
Equity REITs	-0.10	0.41	0.77	0.85	0.66	0.33	1.00

Significance: By using correlation coefficients in portfolio design, simulation of portfolios performance is enhanced, and computerization of the design process becomes possible. Decision-making can be more logical and prudent. It is important to note that negative correlations in the performance of two assets is not bad - in fact, it is attractive because it implies that the portfolio's volatility can be reduced by using various assets with low correlations.