STANDARD DEVIATIONS
Ferrell Research Report -- April 1998

THE POWER OF DIVERSIFICATION:
RISK ALLOCATION MATHEMATICALLY REDUCES YOUR DEPENDENCE ON BEING RIGHT ALL THE TIME

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Much has been written about Markowitz' theory that diversification benefits investment performance. The investment community long ago accepted the mathematical foundation and logic, but implementation of the diversification strategy has been limited:

- It has been applied too narrowly *within* markets. For example, how many *stocks* represent a diversified portfolio of *stocks*?
- The globalization of capital markets has driven correlations of stocks and bonds, both domestic and international, higher and higher. Today the diversification values are becoming less and less.
- Much real diversification (i. e., low correlations) comes from markets that may exhibit too much liquidity risk (real estate), too much sovereign risk (emerging markets), or too much unknown risk (black box hedge funds).

This paper will describe the practical application of Markowitz theory to a set of long/short investment strategies that contain high liquidity, minimal credit or passive market exposure and dependable low correlation. The analysis concludes that these investment strategies may be managed to a desired level of risk with all of the benefits of diversification to harvest more risk adjusted return than any known alternative. The summary identifies the key elements of a successful strategy and the essential qualifications for the manager.

We believe that a stable investment portfolio can be constructed by selecting non-correlating strategies with attractive risk-adjusted returns. We begin by putting all returns on a risk-adjusted basis using the Sharpe Ratio.

$$\text{Sharpe Ratio} = \frac{\text{Total Rate of Return} - \text{90 day Treasury Rate}}{\text{Volatility of Excess Return}}$$

Example: If a portfolio has a volatility of 5%, then

Return	Sharpe Ratio
7.5%	.5
10.0%	1.0
15.0%	2.0

Where does this performance come from?

If we had 'N' managers, of equal Sharpe ratios, in a portfolio with equal risk allocations to each, the portfolio's Sharpe would be $\sqrt{N}$ times the individual Sharpe. For example, if you have a portfolio of four managers who have equal risk

allocations and individual Sharpe ratios of 1.0, the portfolio's Sharpe would be 2.0 (1.0 x √4)

But what if we were not perfect selectors of managers? What if we had, say, only a 50% success rate of picking Asset Managers who will achieve good Sharpes in the future? What success rate do we need to produce an attractive Sharpe for the portfolio?

For example, say we had a portfolio of four managers. Our goal is to produce a portfolio Sharpe of 1.0 or better. We assume that manager performance must be either a Sharpe of 1.0 or zero, (i.e. success or failure), that each performance must have zero correlation to the rest of the group, and that there is a 50/50 chance of success or failure. We allocate equal risk to each strategy. We calculate the odds of having zero, one, two, three, or four successful selections. Let's then calculate the effective portfolio Sharpe for each of these outcomes.

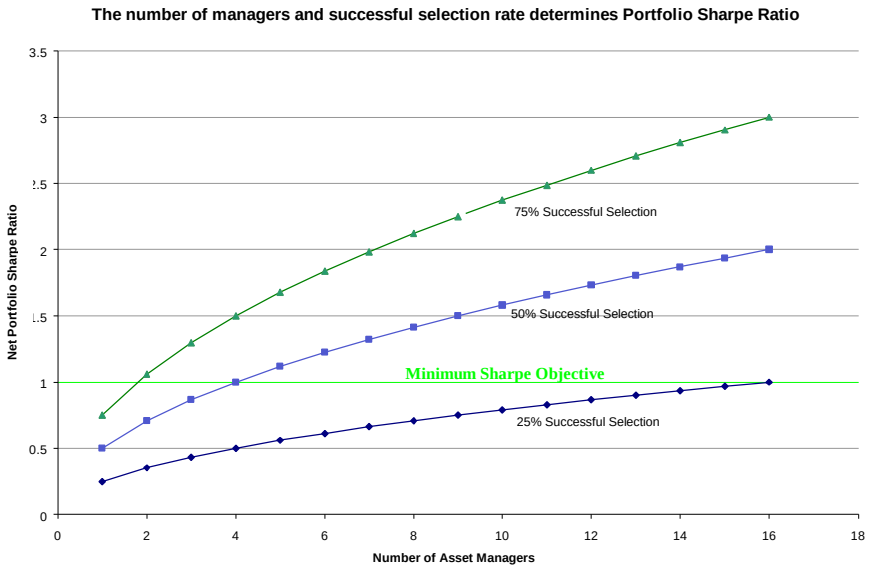
Varying the number of asset managers and the success rate produces the following results:

Four Managers with Sharpes of 1.0 or zero

# of Successful Picks	% of Successful managers	Probability	Effective Portfolio Sharpe
0	0	6.25%	0
1	25	25.0	0.5
2	50	37.5	1.0
3	75	25.0	1.5
4	100	6.25	2.0
	Shaded Total	68.75%	Sharpe ≥ 1.0

We can extend the above table to mean that if we are to select a purely random sample of managers from a universe of those who produce Sharpes of either 0 or 1, we have a 69% probability of achieving a portfolio Sharpe of 1.0 or better.

If we are only 50% successful when selecting profitable Asset Managers, a portfolio of four managers produces a Net Portfolio Sharpe of 1.0. This phenomenon occurs because the lack of correlation permits twice as much, (√4 = 2) total risk to be allocated to each manager than would be possible at the same level of volatility if they were alone or highly correlated. In other words, the total risk of the managers is exactly twice as large as the correlated risk of the portfolio. While the lack of correlation reduces the combined risk of the managers by a factor of two. The portfolio still benefits from having the profit potential from four strategies. The correlation benefit is in this case a risk reduction of 50%.



The Graph shows that if we are more successful (75%) and use more managers (eight), then the portfolio's Sharpe will exceed 2.0. Conversely, if the percentage of successful managers is low, we can achieve our target by increasing the number of managers. The larger the number of managers the higher the correlation benefit. **If 25% of 16 managers are successful, then we still achieve our target portfolio Sharpe of 1.0.** The risk allocation in this example would be four times (√16) the level of a one strategy portfolio.

The bottom line: we don't have to be right all the time; we just have to have a few successful managers, replace unsuccessful ones as necessary, and diversify our picks. The Markowitz Miracle extends to manager selection! The math works.

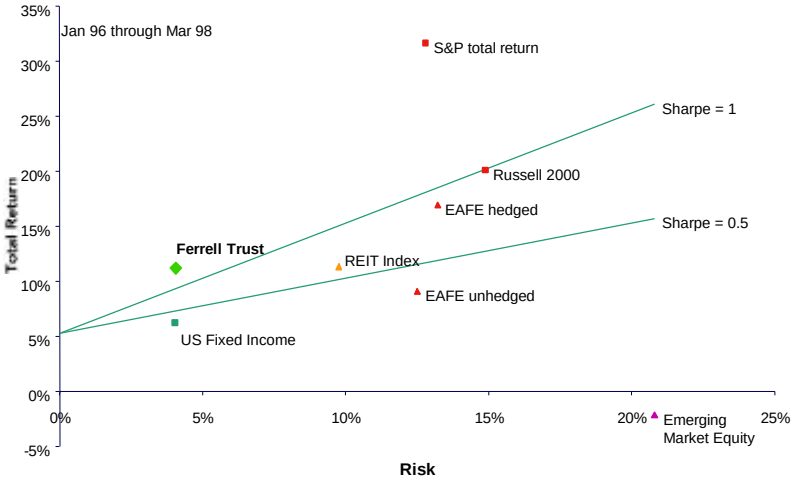
Can we achieve these results in the real world?

Let's return to the assumptions to test the validity of the hypothesis in the real world. What is the likelihood that we can select managers with Sharpes of 1.0 or greater with correlation to each other of zero? The answer is logical and compelling.

1) History has shown that the "long-term" performance of individual asset classes tend to mean-revert about a Sharpe of 0.5. And recent performance has the produced the Risk/Return profiles and Sharpe ratios presented in the Figure to the right. Individually, an index fund, or an active manager working within a single asset class, will be unable to sustain a Sharpe of 1.0 on average.

   Blending the asset classes does improve the overall portfolio. Studies have shown that Sharpe ratios of 0.7 to 0.8 may be expected from portfolios diversifying across these classes, but these still fall short of the 1.0 target.

Long/Short strategies, however, can provide Sharpe ratios in excess of 1.0 because of their inherent advantages.



a. All investment managers use some manner of ranking process to determine where to invest. Instead of being constrained to the options of either investing in those securities deemed to be attractive or investing in cash, the long/short manager can also sell short those securities considered overpriced.

b. Eliminating the constraint of always investing "Long only", with the inherent dependence on price appreciation, enables the long/short manager to produce returns in both rising and falling market environments.

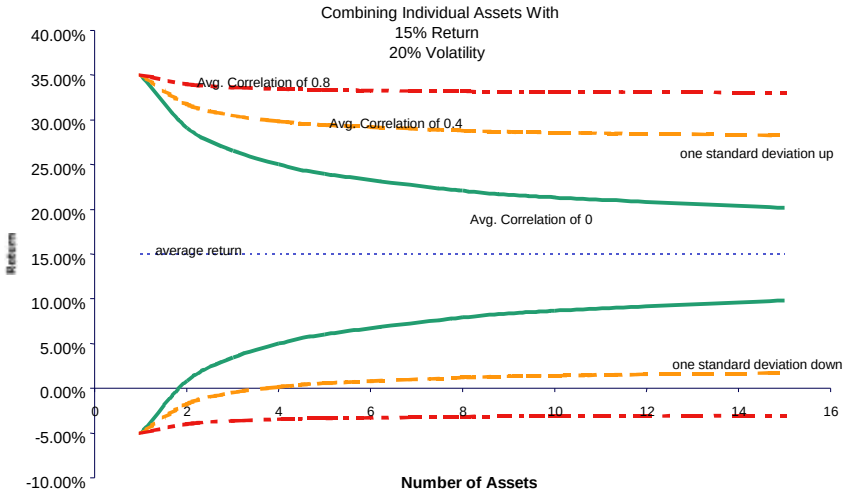
c. Long/short strategies do not rely on nor are they dependent on the Sharpe Ratio of their underlying markets. As noted above over long periods of time, major equity and fixed income markets have a Sharpe Ratio of approximately .5.

2) Diversification through low correlation is key to the Markowitz Miracle. To achieve the above results, the correlation between the managers must, on average, approach Zero. The following Figure presents the marginal impact of an additional asset with different average correlations. We can see that adding assets with 0.8 correlations has little dampening effect on volatility. With the correlation is 0.4, the dampening is improved, but still not substantial. Zero correlations, however, do effectively dampen the volatility. (See Ferrell's study "The Power of Diversification: Impact of Correlation on Net Portfolio Volatility" for a detailed discussion.)

The typical "diversified" portfolio of domestic and international equities, large cap and small cap equities, and domestic and international bonds will not approach the benefits presented above because all of these classes have recently tended to be highly correlated.

However, due to the wide range of strategies and markets that can be utilized, correlations between Long/Short managers tend to be extremely low. The common ground among the managers is that they all have ways of determining which securities or derivatives they consider to be the most attractive to buy and which ones they believe are the most unattractively priced and should be sold. Differences in methodologies, markets, instruments and timing vary across an almost limitless spectrum. i.e., there is simply no reason that a long/short strategy in Japanese equities should ever show a high correlation to a fixed income manager who arbitrages European yield curves. The result is that many liquid strategies with low correlation may be combined to produce lower volatility and, therefore, a higher Sharpe ratio for a given level of risk.

Impact of Correlation on Net Portfolio Volatility



3) "Risk Allocation" is essential to achieving the Markowitz Miracle. Dollars of assets allocated is not an accurate measure of potential returns. Risk drives returns, so an allocation of risk is needed. Value at Risk is an efficient way to measure and allocate risk because it provides a common language across asset classes. Risk must be allocated thoughtfully and measured frequently to ensure stability over time.

4) A new breed of managers use quantitative tools that permit them to set their volatility at desired levels. After the initial level is determined, the volatility of each strategy can then be measured and the correlation of each strategy monitored to ensure desired stability. Then the portfolio can be analyzed as a whole and allocations and target volatilities modified as necessary to ensure continued stable performance.

5) A "manager of managers" approach lends itself to producing the best results from long/short portfolios. The manager should be sufficiently focused to create a structural advantage as a non-conflicted, independent risk manager to gain access to respected managers. Markets change, strategies lose their edge, people change firms and new opportunities arise. If a manager uses only outside managers, strategies may be rebalanced or replaced at the first sign of trouble or better opportunity, not after performance suffers. Large firms run into conflicts of interest with investment managers (who do not want to show them their strategy or positions), competitive clearing firms and investors. As mentioned at the outset of this piece, "playing by the numbers" is critical to the success and stability of performance. A non-conflicted perch is critical to objectivity.

Summary:

Diversification really works. It is also hard to find in the traditional securities markets without piling on more risk to achieve zero correlation. Properly managed long/short strategies in liquid markets can produce excellent risk adjusted returns with manageable volatility and close to zero correlation to each other. On this mathematical foundation we can use currently available technology to build consistently profitable portfolios capable of raising the efficient frontier for virtually all investors in traditional equity and fixed income asset classes.

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