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The Best Way to Invest
Structured Portfolios vs. Active Management

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In 1990, the Nobel Prize in economics was awarded to Harry Markowitz, Merton Miller and Bill Sharpe. These three financial economists have greatly changed the way professional investors form portfolios. Markowitz was the first to show how diversification reduces portfolio risk. Miller developed the equilibrium relation between risk and a firm's cost of capital. Sharpe developed a model of the equilibrium relation between risk and expected investment return.

The work of these three economists, plus the work of others, has led to a new investment paradigm, one of market equilibrium. In the new school of thought, investors can expect capital markets to produce returns for asset classes as rewards for taking diversified risks. The best to form a portfolio is (a) *across asset classes*, to "weight" each asset class so that the portfolio risk is appropriate for the investor and (b) *within asset classes*, to buy all of the securities of an asset class through a broad-based vehicle such as an index fund.

In the new view, everyone can have a good investment experience. It is easy to buy an "asset class" portfolio, such as an index fund. As long as the overall risk level is appropriate, investment losses will not be excessive in the short run and investment returns will line up with risk in the long run.

Dimensional

Using a "structured" investment approach, investing is no longer a zero-sum game. One investor's gain need not be another's loss. Instead, investing becomes a matter of taking market risks and getting market returns.

Capital Markets and Active Management

Research by Miller, Sharpe and other leading academics supports the equilibrium relation between risk and investment returns. On average, risk is rewarded in well diversified portfolios.

The equilibrium relation is a result of our capital markets working efficiently. In our capitalist system, investors supply capital to the users of capital. Expected investment returns and the "cost of capital" are jointly determined by the price at which the demand for capital equals the supply of capital. The higher the price paid for a stock, the lower its expected return and the lower the cost of capital to the stock issuer.

Our capitalist system works best if the market prices for capital are "fair" to both the investors and the users of capital. If one side or the other were systematically disadvantaged, capital markets would not work as efficiently as they do.

A stock's expected investment return, then, is the same thing as the issuing firm's cost of capital. Merton Miller and Franco Modigliani, another Nobel Laureate, show that the cost of capital is related to investment risk[1]. The cost of capital is higher for stocks than for (most) bonds and higher for certain kinds of stocks than for others.

In forming a portfolio, we can achieve higher expected returns by investing in asset classes with higher costs of capital. These are the rewards for taking greater risks.

Active Management: The Disequilibrium View

A different point of view is the disequilibrium premise of "active management." In this view, investment returns are not related to a firm's cost of capital. Assets are mispriced in a way that is perceptible to an active manager but not to the market.

Active Management: Is it a Fair Game?

The man vs. market battle is decidedly one-sided in the favor of markets. Over the years, a number of studies have analyzed the performance of active managers. Exhibit 1 displays the results of a recent study of mutual fund performance[2] by Elton, Gruber, Das and Hlavka. The average mutual fund underperforms a reasonable benchmark by 159 basis points a year. The findings are similar to those reported by Jensen on the period 1946-1965 [3]. Thus, we have 40 years of data covering mutual fund performance and the results are very consistent: active management is not worth its cost.

Brinson and Beebower studied the performance of large pension and profit-sharing funds[4]. They found that the median manager, before fees, underperforms a reasonable benchmark by 71 basis points a year. Once management fees are added back in, the results are about the same as the mutual fund results.

It is sometimes argued that these studies ignore managers who have done exceptionally well. The fact that a few managers do well is not surprising. Given the random wandering in performance, we would expect that a few managers will have what appears to be consistently good performance. At issue is whether or not there are more or fewer such managers than we would expect if stock selection were done randomly.

Exhibit 2 displays the frequency with which managers outperform the benchmark of the S&P 500 plus 1%. The 1% is added because the SEI returns are calculated before deducting management fees. If managers could be expected to do as well as the S&P 500 plus 1%, the distribution of manager results should look like the familiar bell shaped curve of the normal distribution. Instead, the distribution of managers seems to shift to the left. There is no clustering of "good managers." The number of good managers is fewer than we would expect from a random selection of stocks.

Active Management: Is it a Game Worth Playing?

Active management does not appear to be a "fair game". Even if it were, it would not be a game worth playing. The random wandering of performance due to poor diversification makes it a bet not worth taking.

To show how active management performance is hurt by poor diversification, we will compare the results of a structured portfolio to a hypothetical active portfolio using stocks and Treasury bills. Exhibit 3 displays the returns of a U.S. large stock index (the S&P 500 Index) and one-month Treasury bills. The arithmetic average returns and the compound returns are both shown. The differences between the two are the "variance costs."

The compound return is always lower than the average return due to the variance of returns. For example, suppose we have two portfolios. One portfolio has 0% returns in each of two years. One has returns of +50% and -50%. Each has a zero average return. The first has a zero compound return as well. The second has a negative compound return because of its return variability. A $1 investment will be worth $1.50 after the first year and $.75 after the second. Its compound return is -13.4% per year (compounding at -13.4% per year, $1 is worth $.866 at the end of the first year and $.75 at the end of the second).

As can be seen from Exhibit 3, the greater riskiness of stocks causes them to lose more of their returns to variability than bills lose. A portfolio that maintains 50% in the S&P 500 and 50% in Treasury bills has a variance cost of 28 basis points (.28%) per year. The

average variance cost for the S&P 500 and Treasury bills is 58 basis points per year. Thus, diversification adds 30 (58-28) basis points a year.

Active management often involves the timing between stocks and bills. Exhibit 4 displays the median results of a timing strategy that randomly switches between stocks and bills. Each year, a decision is made to be either 100% in stocks or 100% in bills. Half of the time, it will require a switch (transactions costs are assumed to be zero). Half of the time, it will require no turnover. If we simulate the strategy a large number of times, the median results will be similar to those displayed in Exhibit 4.

This simple simulation has similarities to actual active management. It has a 50% turnover rate, which is moderate for actively managed equity portfolios. The simulated results track the benchmark 50/50 portfolio about as well as active managers track their benchmarks (The expected standard error of independent returns for the simulated results is 7.9%, similar to the 8.6% reported by SEI for the median manager active manager).

Exhibit 4 reports a higher variance cost for active management. By being half of the time in stocks and half in bills, the timing portfolio has an expected variance cost equal to the average variance cost of stocks and bills. The diversification benefit is lost.

The risk-reducing benefit of diversification is shown in Exhibit 4 from the standard deviations. The timing portfolio is 40% more risky than the 50/50 (constant mix) portfolio.

The differences in risk between a structured and an active portfolio can be eliminated by allowing the constant mix strategy to invest a higher percentage in stocks. Exhibit 5 displays the results of a portfolio that is 71.7% invested in stocks and 28.3% in bills. It has the same risk as the active portfolio and 109 basis points per year higher return.

The research on active manager performance focuses on the ability of the median manager to beat a performance benchmark. As bad as his performance is, the median manager nevertheless outperforms half of the other managers. Exhibit 6 displays the range in average returns that can occur with the random timing strategy. 5% of the simulations can underperform the median by 230 basis points a year for 30 years.

The random drift of relative performance is possibly the biggest problem with active management and is probably the least understood. Its effects are similar to a coin-flipping contest where the contestant either wins $1 or loses $1 depending on the result of the flip. With a large number of trials, the average gain or loss will get extremely close to zero. However, the total gain or loss is likely to be far from zero.

Exhibit 7 displays the ranges in average gain or loss and in total gain or loss from the coin-flipping contest. Also shown is the pattern of results for a sequence of 10000 flips. It displays the counter-intuitive aspect of random numbers. They appear to have predict-

able patterns. The clumping of results sometimes makes it appear that the coin flipper has "skill." Active manager results follow this same random behavior. We can never separate the good performance of a manager into that part that was due to skill from that part that was due to luck.

Thus, structured portfolios can increase returns by investing in a broader array of asset classes. Broad diversification enables investors to reliably receive the appropriate return for the risk taken.

Structured Portfolios and the Benefits of Diversification

Structured portfolios, by buying asset classes in appropriate amounts, have higher expected returns than actively managed portfolios. By maintaining relatively constant weights, a structured portfolio captures the two primary benefits of diversification, risk reduction and increased compound returns.

Exhibit 8 displays how diversification reduces risk. Displayed are returns and standard deviations of three asset classes plus two portfolio combinations. The first portfolio rebalances each month to maintain 60% in the S&P 500 and 40% in the Shearson/ Lehman Government Corporate Index. The second portfolio takes the 60% in stocks and invests 15% in the EAFE Index and 45% in the S&P 500.

For the 21 years, the global portfolio has higher compound return than the domestic portfolio and a lower standard deviation of returns. The EAFE Index has the highest standard deviation of the three asset classes, but a 15% commitment to EAFE lowers the portfolio standard deviation. The risk-reducing benefits of diversification are large enough to offset the greater volatility of EAFE. The first dollar invested in an asset class provides a greater diversification benefit than the last dollar invested. With a 15% commitment to EAFE, the diversification benefits can overcome EAFE's greater standard deviation.

In other words, EAFE is riskier than the S&P 500 when the two assets are considered separately and less risky than the S&P 500 when included in a balanced portfolio that weights the S&P 500 much more heavily than EAFE. The reason is that the measure of risk of an asset in a portfolio is its covariance, not its variance or standard deviation (the square root of the variance). Much of the variance of an asset's returns gets diversified away in a portfolio. What remains is the covariance. All other things being equal, the lower the weight of an asset in a portfolio and the lower its correlation of returns with other assets in the portfolio, the lower the covariance.

The difference between the variance and the covariance can be seen in Exhibit 9. Displayed are the variances and covariances of the three assets in the global portfolio for

seven three-year periods. It is generally the case that EAFE has a greater return variance than the S&P 500 and a lower return covariance.

Diversification Benefits Lost to Active Management

Active management gives away diversification benefits in order to try to beat the market. Consequently, diversification benefits are assured only for portfolios that maintain relatively constant asset weights. In an extreme example, the risk-reducing benefit of EAFE could be lost if an active manager invests in too few issues or causes EAFE's weight in a portfolio to vary widely.

More Examples of the Benefit of Diversification

Table 10 provides six examples of the benefits of diversification over the last ten years. Three new asset classes are used in portfolio construction. Dimensional's 6-10 Strategy is used as the proxy for U.S. small stocks and Dimensional's International Small Stock Strategy is used for international small stocks. The Fixed Income Portfolio is a combination of 50% Dimensional's One-Year Strategy and 50% Dimensional's Five-Year Strategy. Beginning in 1991, the 25% is taken from the Five-Year Strategy and placed in Dimensional's Global Fixed Income Strategy.

The first panel displays the asset weights. The second panel displays the standard deviations of returns, annualized from monthly data, and diversification returns. A diversification return is the difference between the portfolio's compound return and the weighted average compound return of the assets in the portfolio. For example, taking 60% of the S&P 500's compound returns and 40% of the Fixed Income's return gives a result that is .29% per year lower than the compound return for Portfolio 1.

The third panel displays risk measures for each asset in a portfolio. Betas are displayed in addition to covariances. An asset's beta, relative to the portfolio, is its covariance divided by the variance of the portfolio's returns. The weighted average beta is always 1.0. For example, in Portfolio 1, 60% of the S&P 500's beta and 40% of the Fixed income's beta adds to 1.0.

As can be seen in Exhibit 10, the risk of the S&P 500 in most portfolios is at least as great as the risks of the other assets. The risk-reducing benefit of diversification is strong enough to eliminate most of the additional risks inherent in U.S. small stocks and international stocks.

Conclusion

The equilibrium view of capital markets leads to holding asset class, structured portfolios. A disequilibrium of capital markets leads to active management. Active

management appears to be a loser's game. Even if it were a fair game, active management is not a game worth playing due to its random wandering of performance.

Structured portfolios capture enormous diversification benefits. Active management discards these benefits. Diversification takes a seemingly high-risk asset, such as EAFE, and transforms it into a low-risk asset.

References

1. Markowitz, Harry M., "Portfolio Selection", *Journal of Finance*, Vol. VII, No. 1, March 1952, pp. 77-91.

2. Edwin J. Elton, Martin J. Gruber, Sanjiv Das, and Matthew Hlavka, *Efficiency with Costly Information: A Reinterpretation of Evidence from Managed Portfolios*, The Society for Financial Studies, 1993.

3. Jensen, Michael C., The Performance of Mutual Funds in the Period 1945-64", *Journal of Finance*,Vol. 23, December 1965, pp. 587-616.

4. Gary P. Brinson, L. Randolph Hood and Gilbert L. Beebower, "Determinants of Portfolio Performance", *Financial Analysts Journal*, July-August 1986, pp. 39-44; and Gary P. Brinson, Brian D. Singer and Gilbert L. Beebower, "Revisiting Determinants of Portfolio Performance: An Update", 1990.

5. SEI Corporation, *1993 Consistency Study*, Working Paper.

Exhibit 1
Performance of Mutual Funds
1965-1984

Average Equity Commitment (%)	Number of Funds	Avg Annual Alpha (%)	Avg Alpha t-stat	$b_{S\&P}$	b_C	b_{Bonds}	Average Correlation (R^2)
Less than 65%	32	-1.41	-2.77	0.70	0.12	0.65	0.85
Between 65 and 90%	75	-1.92	-2.21	0.98	0.25	0.01	0.82
Over 90%	36	-1.07	-1.16	1.06	0.21	-0.09	0.84
Total	143	-1.59	-2.35	0.94	0.21	0.13	0.83

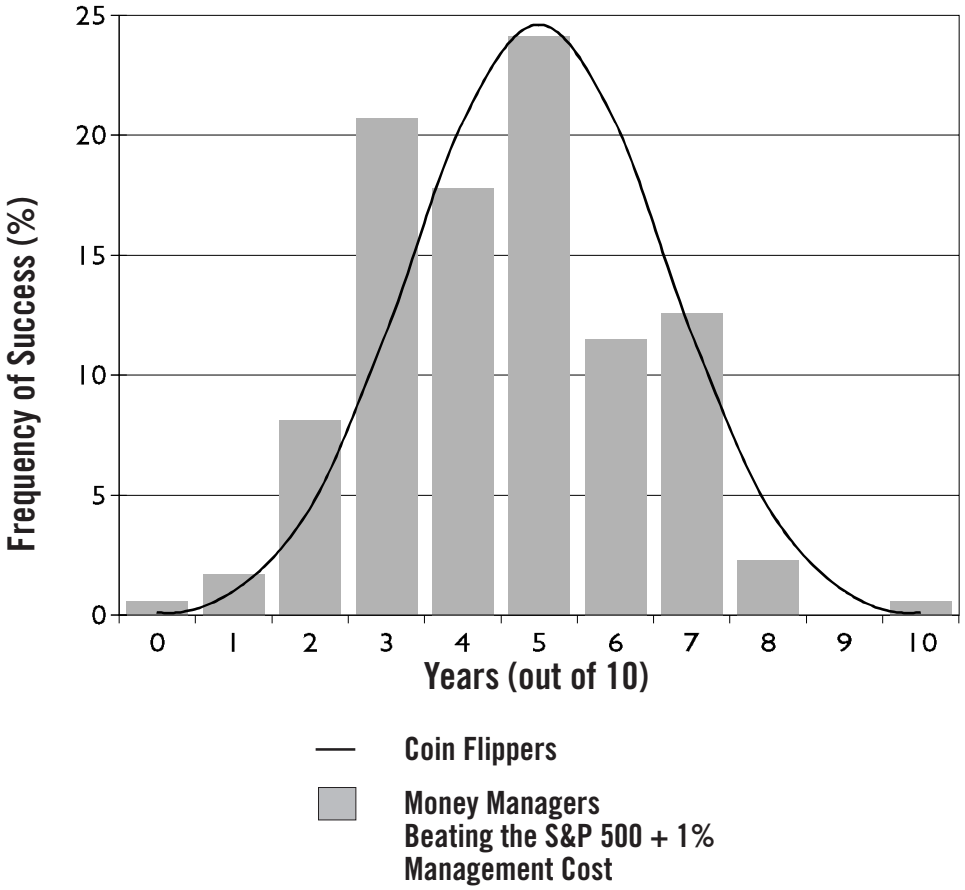
$b_{S\&P}$ = Sensitivity to S&P 500
b_{SC} = Sensitivity to Small Company Stocks
b_{TB} = Sensitivity to Treasury Bonds

	Number of Funds	
with Positive, and Significant, Alphas	0	
with Positive, But Not Significant, Alphas		34
with Negative, But Not Significant, Alphas	88	
with Negative, and Significant, Alphas	21	
Total		143

Reference: Edwin J. Elton, Martin J. Gruber, Sanjiv Das, and Matthew Hlavka, *Efficiency with Costly Information: A Reinterpretation of Evidence from Managed Portfolios*, The Society for Financial Studies, 1993.

Exhibit 2
Security Selection
Do active managers perform better than a random flipping of coins?

Number of Years (out of 10) Active Money Managers beat the S&P 500 + 1% Management Cost and Number of Times (out of 10)



Source: SEI Corporation (1984-1993).
Manager returns are calculated without subtracting fees.

Exhibit 3
Benefits of Diversification
Annual Returns
(%)
1964-1993

	S&P 500 Index	One-Month Treasury Bills	Structured Portfolio: 50% S&P 500 Index 50% Treasury Bills
Average Return (%)	**11.58**	**6.68**	**9.13**
Compound Return (%)	**10.46**	**6.65**	**8.85**
Variance Cost (%)	**1.12**	**.03**	**.28**

Variance Cost: Average return minus compound return

Diversification Return: $\frac{(1.12 + .03)}{2}$ - .28% = .58% - .28% = .30%

The average variance cost for the S&P 500 and Treasury Bills is .58% per year. A 50/50 portfolio has a variance cost of only .28%. Thus, diversification adds 30 basis points a year to return (.58% - .28%).

SEI median standard error of independent returns for active managers is 8.6%.
Expected standard error of simulated strategy is 7.9%.

Exhibit 4

Cost of Active Management
Loss of Diversification/Increased Variance
Annual Returns
(%)
1964-1993

	Structured Portfolio: 50% S&P 500 Index 50% Treasury Bills	Active Portfolio (no value added): Either 100% S&P 500 or 100% Treasury Bills	Structured minus Active Portfolio
Average Return (%)	**9.13**	**9.13***	**0.00**
Compound Return (%)	**8.85**	**8.54**	**0.31**
Standard Deviation	**7.86**	**11.16**	**-3.30**

Active management loses the diversification return because of its higher variance.

***The active management return is the median outcome that would come from a large number of simulations.**

SEI median standard error of independent returns for active managers is 8.6%.
Expected standard error of simulated strategy is 7.9%.

Exhibit 5
Cost of Active Management
Opportunity Costs
Annual Returns
(%)
1964-1993

	Structured Portfolio: 71.7% S&P 500 Index 28.3% Treasury Bills	Active Portfolio (no value added): Either 100% S&P 500 or 100% Treasury Bills	Structured minus Active Portfolio
Average Return (%)	**10.22**	**9.13***	**1.09**
Compound Return (%)	**9.63**	**8.54**	**1.09**
Standard Deviation	**11.16**	**11.16**	**0.00**

A structured portfolio takes risk more efficiently. For the same return volatility, it has a 109 basis point higher return than the active portfolio.

***The active management return is the median outcome that would come from a large number of simulations.**

SEI median standard error of independent returns for active managers is 8.6%.
Expected standard error of simulated strategy is 7.9%.

Exhibit 6
Cost of Active Management
Effects of Random Drift
Annual Returns
(%)
1964-1993

Active Portfolio (no value added):
Either 100% S&P 500 Index or
100% Treasury Bills

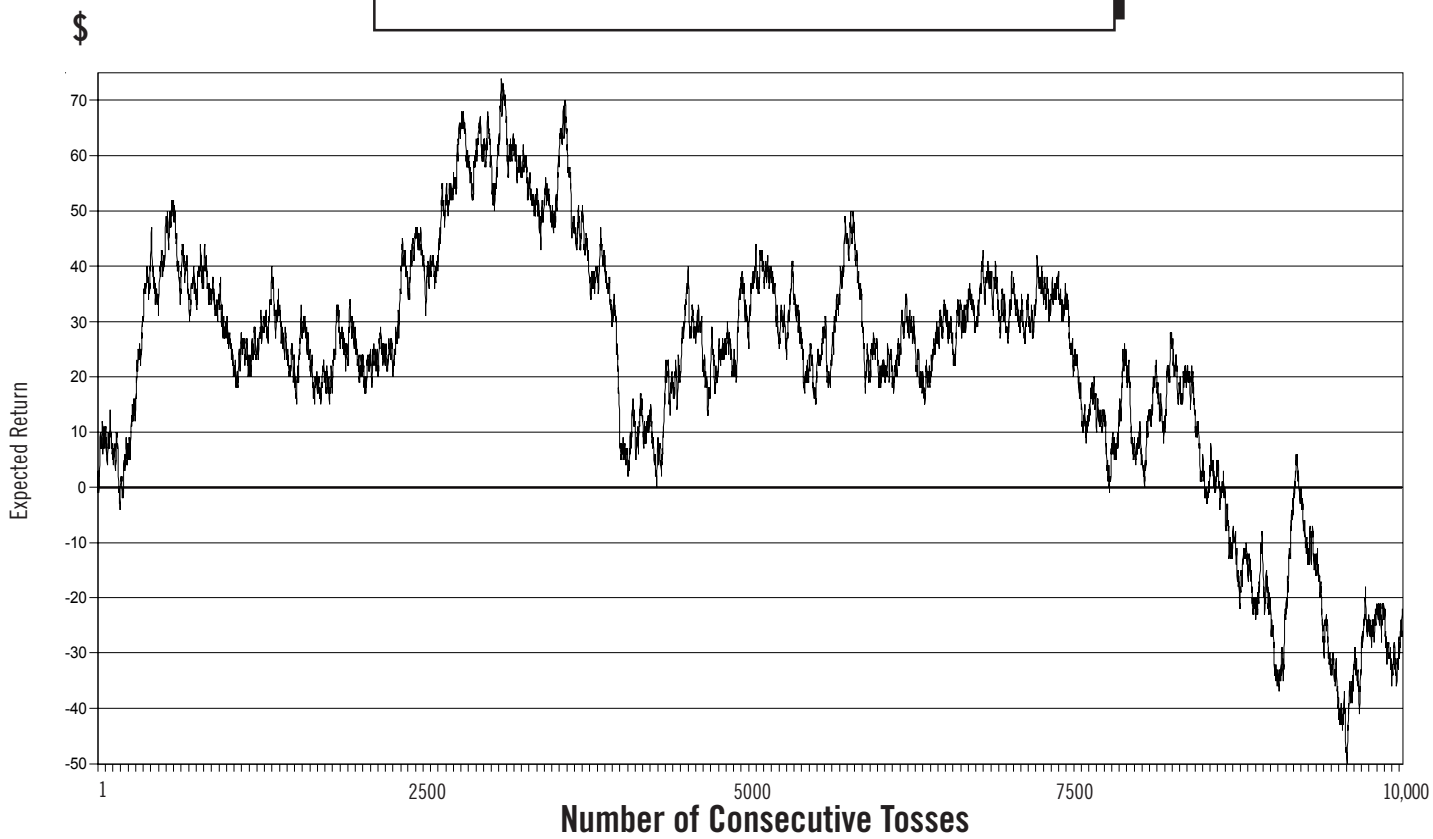
	Range in Average Returns for a Large Number of Participants
50th Percentile	**9.13**
33rd Percentile	**7.68**
5th Percentile	**6.81**

(Standard Error of Independent Returns is 7.9%)

The research on active management tries to determine if the median manager does as well as his structured benchmark. Half of the managers do worse than the median manager. If a large number of investors engage in the random timing strategy, about 5% would have average returns 2.3% per year below the median investor.

Exhibit 7
Effects of Random Wandering on Coin-Tossing Game
$1 Gain or Loss per Toss
Expected Return: $0.00

Number of Tosses	95% Confidence Limits (+/-) Average Return per Toss (¢) Low		High	Total Gain or Loss
100	-20	to	20	$20
10,000	-2	to	2	$200
1 million	-.2	to	.2	$2000
100 million	-.02	to	.02	$20,000
10 billion	-.002	to	.002	$200,000



- **Random wandering of relative performance is an indirect cost of active management.**

Exhibit 8
Investment Risk and Return
1973-1993

	S&P 500 Index	EAFE Index	Shearson Lehman Govt/Corp	60% S&P 500 40% SL Govt/Corp	45% S&P 500 15% EAFE 40% SL Govt/Corp
Annualized Return (%)	11.27	12.89	9.52	10.87	11.25
Monthly Standard Deviation	4.60	5.24	1.94	3.12	2.91

Exhibit 9
Variances Vs. Covariances
Three-Year Periods
1973-1993

Example Portfolio: 45% S&P 500
15% EAFE
40% SL Govt/Corp

	Monthly Variances			Monthly Covariances		
36-Month Period	S&P 500 Index	EAFE Index	Shearson Lehman Govt/Corp Index	S&P 500 Index	EAFE Index	Shearson Lehman Govt/Corp Index
1973-1975	0.33	**0.37**	0.03	**0.20**	0.17	0.04
1976-1978	**0.16**	0.15	0.01	**0.08**	0.03	0.01
1979-1981	0.19	**0.20**	0.11	**0.12**	0.11	0.08
1982-1984	0.18	**0.20**	0.04	**0.11**	0.08	0.03
1985-1987	**0.37**	0.30	0.03	**0.20**	0.12	0.02
1988-1990	0.17	**0.41**	0.02	0.11	**0.12**	0.03
1991-1993	0.10	**0.25**	0.01	0.06	**0.07**	0.01

Box indicates highest return for time period.

Exhibit 10
Diversification Benefits
Risk Reduction: Six Portfolios
1984-1993

	Portfolio					
	1	2	3	4	5	6
U.S Large (S&P 500)	60	45	45	45	30	15
U.S. Small (Deciles 6-10)				5	10	15
International Large (EAFE)		15		5	10	15
International Small			15	5	10	15
Fixed Income	40	40	40	40	40	40
Standard Deviation (Ann. %)	9.62	9.05	8.94	9.10	8.95	9.18
Diversification Return (Ann. %)	0.29	0.46	0.45	0.44	0.55	0.63
Risk Measures Relative to Portfolio Returns:						
Betas						
U.S. Large (S&P 500)	1.61	1.63	1.64	1.67	1.59	1.38
U.S. Small (Deciles 6-10)				1.72	1.68	1.50
International Large (EAFE)		1.52		1.31	1.63	1.81
International Small			1.48	1.22	1.56	1.76
Fixed Income	0.09	0.10	0.10	0.09	0.09	0.08
Covariances (Ann. %)						
U.S. Large (S&P 500)	1.49	1.33	1.31	1.38	1.27	1.17
U.S. Small (Deciles 6-10)				1.42	1.34	1.26
International Large (EAFE)		1.25		1.08	1.31	1.53
International Small (Deciles 6-10)			1.19	1.01	1.25	1.48
Fixed Income	0.08	0.08	0.08	0.08	0.07	0.07

	Annualized Standard Deviation (%)	Annualized Variance (%)
U.S. Large (S&P 500)	15.6	2.43
U.S. Small (Deciles 6-10)	20.7	4.28
International Large	21.4	4.58
International Small	21.2	4.49
Fixed Income	2.9	0.08

For information on data series see *Sources and Descriptions of Data.*