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DIVERSIFIED PORTFOLIO ETFS PERFORMANCE ANALYSIS OPTIMIZING THE RETURN TO RISK RATIO

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Diversified Portfolio Etfs: Performance Analysis & Optimizing the Return to Risk Ratio

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I. Introduction

Exchange traded funds (ETFs) are index funds whose shares are listed on a stock exchange and traded like equity securities at market prices. ETFs allow investors to buy or sell shares of a fund that represents the collective performance of a selected group of securities. ETFs are designed to add the flexibility, ease and liquidity of stock trading to the benefits of traditional index-fund investing. ETFs are securities certificates that state legal right of ownership over part of a basket of individual stock certificates.

The Eight Diversified Portfolio ETFs used in the study were:-

a) iShares S&P Moderate Allocation fund (AOM)

AOM Tracks the S&P Target Risk Moderate Index. The Index is designed to measure the performance of S&P's proprietary moderate target risk allocation model

b) S&P Growth Allocation Profile (AOR)

AOR Tracks the S&P Target Risk Growth Index. The Index is designed to measure the performance of S&P's proprietary growth target risk allocation model.

c) S&P Conservative Allocation Profile (AOK)

AOK Tracks the S&P Target Risk Conservative Index. The Index is designed to measure the performance of S&P's proprietary conservative target risk allocation model

d) S&P Aggressive Allocation Profile (AOA)

AOA Tracks the S&P Target Risk Aggressive Index. The Index is designed to measure the performance of S&P's proprietary aggressive target risk allocation model.

e) RiverFront Tactical Balanced Growth Portfolio Profile (PAO)

PAO Tracks the RiverFront Global Tactical Balanced Growth Index. The Index is optimized relative to a growth risk profile targeting approximately 80% equities and 20% taxable fixed income.

f) RiverFront Tactical Growth & Income Portfolio Profile (PCA)

PCA Tracks the RiverFront Global Tactical Balanced Growth & Income Index. The Index is optimized relative to a growth risk profile targeting approximately 50% equities and 50% fixed-income securities.

g) Claymore CEF GS Connect ETN Profile (GCE)

GCE Tracks the Claymore CEF Index. The Claymore CEF Index is a 100% rules-based index that is designed to track the performance of a weighted basket of closed-end funds selected based on liquidity, income distribution and market valuation, among other factors.

h) Ibbotson Alternative Completion Portfolio Profile(PTO)

PTO Tracks the Ibbotson Alternative Completion Index. The Index is compiled and calculated by Ibbotson, using a proprietary methodology to select underlying ETFs, ETNs, and equity and fixed-income securities covering a group of asset classes and investment strategies.

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II. Methodology

For the research purpose, eight Diversified Portfolio ETFs were used and compared it with the S&P 500 index for the time period starting from January 2009 to January 2012. The study used four moments i.e. Mean, Standard deviation, Kurtosis and Skewness to study the return characteristics of the ETFs and market. Kurtosis characterized the relative peakedness or flatness of a distribution compared with the normal distribution. Positive kurtosis indicated a relatively peaked distribution. Negative kurtosis indicated a relatively flat distribution. Skewness characterized the degree of asymmetry of a distribution around its mean. Positive skewness indicated a distribution with an asymmetric tail extending toward more positive values. Negative skewness indicated a distribution with an asymmetric tail extending toward more negative values. Thereafter, Sharpe Ratio and Treynor Ratio were calculated to analyze the performance of ETFs relative to the S&P 500 index.

The Sharpe Ratio, or Sharpe Index, measures the mean excess return per unit of risk in an investment asset or a trading strategy. The Sharpe Ratio is defined as:

$$S = \frac{E[R - R_f]}{\sigma} = \frac{E[R - R_f]}{\sqrt{Var[R - R_f]}}$$

where R is the asset return, Rf is the return on a benchmark asset, such as the risk free rate of return, E[R – Rf] is the expected value of the excess of the asset return over the benchmark return, and σ is the standard deviation of the excess return (Sharpe 1994). The Sharpe Ratio is used to characterize how well the return of an asset compensates the investor for the risk taken. When comparing two assets each with the expected return E[R] against the same benchmark with return Rf, the asset with the higher Sharpe Ratio gives more return for the same risk.

Treynor ratio, also known as reward to volatility ratio, or Treynor's measure a risk-adjusted measure of return based on systematic risk. It is similar to the Sharpe ratio, with the difference being that the Treynor ratio uses beta as the measurement of volatility.
Treynor's ratio is calculated as:

$$T = \frac{r_i - r_f}{\beta_i}$$

where:

T - Treynor ratio,
r_i- return,
r_f - risk free rate
β_i - Beta

The beta for the ETFs was calculated by using the S&P 500 as an independent variable.

The R-Squared or Coefficient of Determination indicates the percentage of the variation in the dependent variable can be explained and accounted for by the independent variables in this regression analysis. The Multiple Correlation Coefficient (Multiple R) measures the correlation between the actual dependent variable (Y) and the estimated or fitted (Y) based on the regression equation. This is also the square root of the Coefficient of Determination (R-Squared). Regression analysis was also used to determine the relationship of S&P 500 with each of the eight Diversified Portfolio ETFs. In Asset allocation optimization model, Stochastic Optimization was used to allocate the investor's investment to the Diversified Portfolio ETFs so that the return to risk ratio was maximized subject to various constraints and requirements. That is, to allocate 100% of an investor's investment among Diversified Portfolio ETFs. A simulation with 100 trials was run, and then an optimization was run. Then this process was replicated 20 times to obtain the optimal results.

III. Analysis

The exhibits I and II reflected the yearly returns for eight Diversified Portfolio ETFs and S&P 500 index for last three years. After the recession in 2008 when the markets were recovering, it was seen that most of the Diversified Portfolio ETFs were giving positive returns with highest being given by GCE i.e. 31.48% which indicated that only two out of eight were having returns higher than that of S&P 500 index in 2009. In 2010 due to economic slowdown in US the returns started decreasing and only one ETF i.e. AOA with the returns value of 20% was having higher returns than that of the market. In 2011 when most of the ETFs were giving negative returns only AOK with a value of 3% was having higher returns than that of the market. It was also found that yearly average returns for none of the ETFs was higher as than that of S&P 500 index having just 17.29% value.

Exhibit III indicated that mean monthly returns of all eight ETFs with a maximum value of 1.3% were lower than that of S&P 500 index having a value of 1.4%. The standard deviation values implied that the volatility of returns in all the ETFs ranged from 1.4% to 5.2% with AOA having the maximum value of 5.2% was lower as compared with that of S&P 500 which is having a value of 5.3% which showed that ETFs were less risky as compared to market. The negative kurtosis values of most of ETFs and S&P 500 index suggested that distribution curves for the three year mean returns was less leptokurtic (which means that lesser values were

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close to the mean returns). The negative Skewness values of most of the ETFs and S&P 500 index suggested that distribution curves of returns were negatively skewed which indicated that the tail on the left side of the probability density function is longer than the right side and the bulk of the values (possibly including the median) lie to the right of the mean.

Exhibits IV and V reflected that the six out of eight Diversified Portfolio ETFs ranging between 1.69 and 1.8 had higher Sharpe and Treynor ratios than that of S&P 500 index which indicated that six ETFs outperformed the market in 2009. For the year 2010, the Sharpe ratio for all the ETFs varied from 0.62 to 1.2 whereas the Treynor ratio varied from 0.12 to 0.25 which indicated that the Sharpe and Treynor ratio of two ETFs was higher than that of S&P 500 index. Finally, in the year 2011 the Sharpe ratio for the ETFs varied from -0.4 to 0.4 and the Treynor ratio from -0.08 to 0.08 but the Sharpe ratio was highest for AOK which indicated that only AOK outperformed the market.

Exhibits VI and VII showed the three yearly Sharpe and Treynor Ratios for all ETFs and S&P 500 index. The three yearly Sharpe ratio for all ETFs varied from 0.34 to 0.64 indicated that for only two out of eight ETFs it was higher than that of S&P 500 which indicated that only two of the ETFs outperformed the market. Similarly the treynor ratio was in tandem with the Sharpe ratio and indicated that only few ETFs outperformed the market in last three years.

It was seen from the Exhibits VIII that S&P 500 index was used as independent variable for regression analysis taking each of the Diversified Portfolio ETFs as dependent variables. When regression analysis was done it was found that the coefficient of determination (COD) ranged from 0.85 to 0.99 which showed that when S&P 500 was used to estimate the movement of Diversified Portfolio ETFs, then 99% of variation was captured by this index, rest 1% was explained by exogenous factors while correlation coefficient(R) ranged from 0.92 to 0.99 which indicated that the ETFs were highly correlated with the market.

Exhibit IX indicated the Asset Allocation Optimization Model of Diversified Portfolio ETFs with assigning equal investments to all Diversified Portfolio ETFs before running the optimization. It was seen that when equal investments were assigned to the Diversified Portfolio ETFs then the return to risk was 1.2 with the portfolio returns of just 6.2% and volatility was 4.9% which indicated that the portfolio of ETFs was not optimized.

Exhibit X indicated the Asset Allocation Optimization Model of Diversified Portfolio ETFs with assigning 0% to 100% of the investments to all Diversified Portfolio ETFs after running the optimization. It was seen that the Return to risk ratio was increased to 1.4 while the portfolio returns decreased to 5.2% and portfolio risk to 3.6%. The maximum investment allocation of 41% was assigned to AOK ETF. So it can be said that if the investors want to invest in Diversified Portfolio ETFs then return to risk ratio will be maximized when he has invested the majority of his investments in iShares S&P Moderate Allocation fund and S&P Conservative Allocation Profile in last three years.

IV. Conclusion

The research study investigated the performance of Diversified Portfolio ETFs relative to market. The results implied that only few of the Diversified Portfolio ETFs had higher yearly returns than that of market during last three years. It was also seen that Diversified Portfolio ETFs had lower volatility in returns than S&P 500 index. The study also depicted that none of the Diversified Portfolio ETFs had higher three year average returns than that of the market index. The yearly Sharpe and Treynor ratios indicated that most of ETFs outperformed the S&P 500 index in only one year out of last three years. The Three yearly Sharpe and Treynor ratios also indicated that only two ETFs outperformed the market. The results also implied that the coefficient of determination was high when ETFs were regressed with the S&P 500 index which indicated that the maximum variation in movement of ETFs was explained by the market. It was also found that the ETFs were highly correlated with the S&P 500 during the last three years. The results also implied that if the investors want to invest in Diversified Portfolio ETFs then return to risk ratio will be maximized when he has invested the majority of his investments in iShares S&P Moderate Allocation fund and S&P Conservative Allocation Profile in last three years.

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YEAR	AOM	AOA	AOK	AOR	PAO	PCA	GCE	PTO	S&P 500
2009	14.26%	29.63%	9.00%	20.38%	25.28%	21.04%	31.48%	31.38%	30.03%
2010	8.41%	20.02%	6.09%	12.82%	15.00%	10.19%	11.52%	10.81%	19.76%
2011	1.29%	-0.17%	3.01%	0.97%	-6.17%	-2.18%	-3.85%	-1.54%	2.09%
AVERAGE	7.99%	16.49%	6.03%	11.39%	11.37%	9.68%	13.05%	13.55%	17.29%

Exhibit I : Yearly returns of Diversified Portfolio ETFs and S&P 500 index

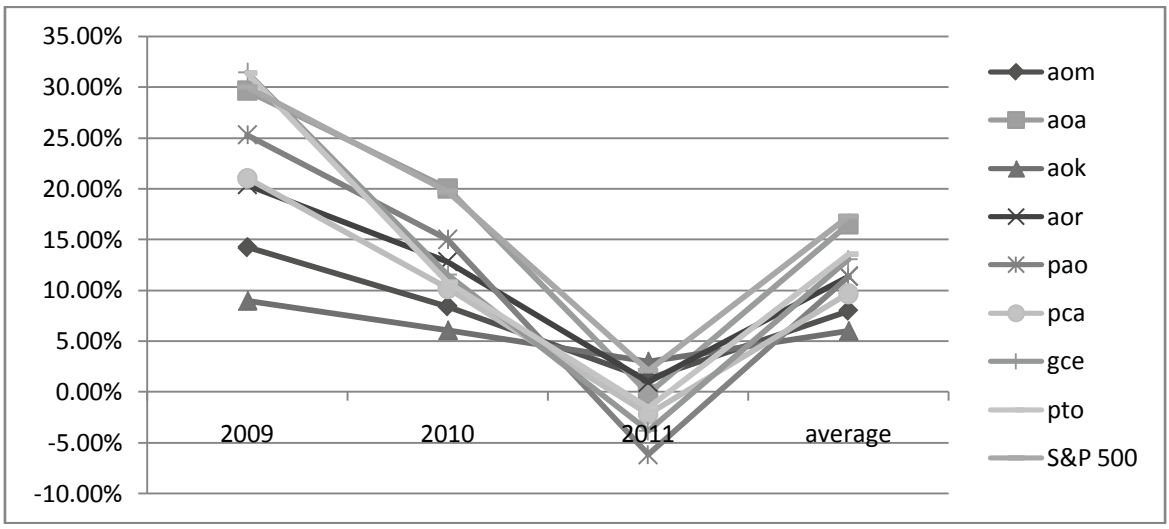

Exhibit II : Comparison of yearly returns of Diversified Portfolio ETFs and S&P 500 index

	AOM	AOA	AOK	AOR	PAO	PCA	GCE	PTO	S&P 500
Mean	0.007	0.014	0.005	0.009	0.010	0.008	0.011	0.011	0.014
Standard Deviation	0.023	0.052	0.014	0.035	0.048	0.035	0.050	0.050	0.053
Kurtosis	-0.349	-0.624	0.088	-0.561	-0.427	-0.078	1.448	0.260	-0.326
Skewness	-0.361	-0.210	-0.324	-0.264	-0.354	0.025	-0.321	-0.329	-0.371
Range	0.094	0.192	0.063	0.135	0.186	0.153	0.269	0.215	0.218
Minimum	-0.051	-0.091	-0.032	-0.066	-0.092	-0.064	-0.126	-0.104	-0.110
Maximum	0.043	0.102	0.030	0.069	0.094	0.089	0.143	0.111	0.108
Sum	0.237	0.490	0.179	0.338	0.343	0.288	0.389	0.406	0.515

Exhibit III : Descriptive Statistics of monthly returns of Diversified Portfolio ETFs and S&P 500 index

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YEAR	AOM	AOA	AOK	AOR	PAO	PCA	GCE	PTO	S&P 500
2009	1.758	1.638	1.809	1.693	1.510	1.737	1.808	1.808	1.642
2010	1.040	1.108	1.230	1.067	0.897	0.841	0.661	0.622	1.083
2011	0.037	-0.065	0.410	-0.002	-0.430	-0.264	-0.279	-0.147	0.060

Exhibit IV : Comparison of Yearly Sharpe Ratio of ETFs and S&P 500 index

YEAR	AOM	AOA	AOK	AOR	PAO	PCA	GCE	PTO	S&P 500
2009	0.328	0.301	0.368	0.312	0.288	0.337	0.396	0.375	0.299
2010	0.194	0.204	0.250	0.197	0.171	0.163	0.145	0.129	0.197
2011	0.007	-0.012	0.083	0.000	-0.082	-0.051	-0.061	-0.030	0.011

Exhibit V : Comparison of Yearly Treynor Ratios of ETFs and S&P 500 index

Year	AOM	AOA	AOK	AOR	PAO	PCA	GCE	PTO	S&P 500
Sharpe	0.528	0.489	0.646	0.512	0.349	0.421	0.387	0.409	0.512
treynor	0.098	0.090	0.131	0.094	0.066	0.082	0.085	0.085	0.093

Exhibit VI : Three yearly Sharpe & Treynor Ratios of ETFs and S&P 500 index

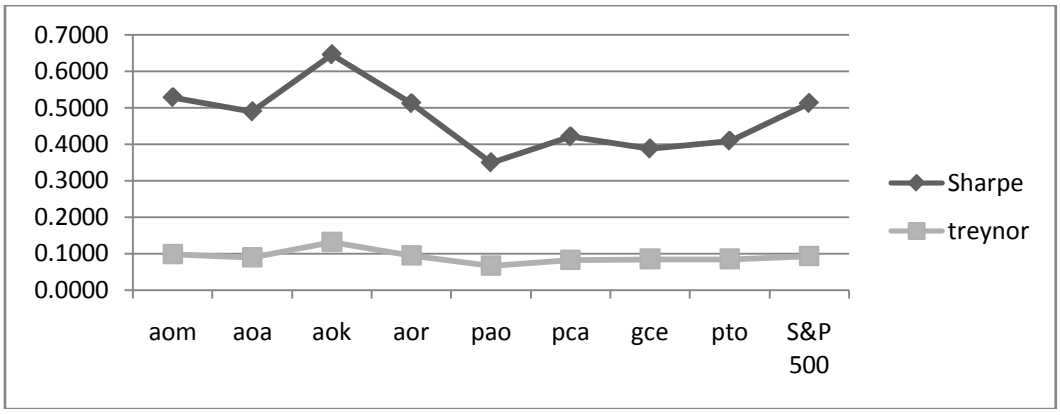

Exhibit VII : Comparison of Three yearly Sharpe & Treynor Ratios of ETFs and S&P 500 index

	AOM	AOA	AOK	AOR	PAO	PCA	GCE	PTO
COD	0.98	0.99	0.95	0.99	0.92	0.96	0.85	0.91
R	0.99	1.00	0.97	1.00	0.96	0.98	0.92	0.95

Exhibit VIII : Regression Analysis of ETFs with S&P 500 index.

ASSET ALLOCATION OPTIMIZATION MODEL					
Asset Class Description	Annualized Returns	Volatility Risk	Allocation Weights	Required Minimum Allocation	Required Maximum Allocation
AOM	4.64%	8.04%	12.50%	0.00%	100.00%
AOA	9.20%	18.01%	12.50%	0.00%	100.00%
AOK	3.56%	4.90%	12.50%	0.00%	100.00%
AOR	6.52%	11.96%	12.50%	0.00%	100.00%
PAO	6.22%	16.66%	12.50%	0.00%	100.00%
PCA	5.46%	12.04%	12.50%	0.00%	100.00%
GCE	7.11%	17.34%	12.50%	0.00%	100.00%
PTO	7.47%	17.29%	12.50%	0.00%	100.00%
Portfolio Total	*6.2729%*	*4.97%*	*100.00%*		
Return to Risk Ratio	*1.2633*				

Exhibit IX : Asset Allocation Optimization Model of Diversified Portfolio ETFs with assigning equal investments to all Diversified Portfolio ETFs before optimization.

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ASSET ALLOCATION OPTIMIZATION MODEL					
Asset Class Description	Annualized Returns	Volatility Risk	Allocation Weights	Required Minimum Allocation	Required Maximum Allocation
AOM	4.64%	8.04%	17.85%	0.00%	100.00%
AOA	9.20%	18.01%	7.05%	0.00%	100.00%
AOK	3.56%	4.90%	36.79%	0.00%	100.00%
AOR	6.52%	11.96%	11.31%	0.00%	100.00%
PAO	6.22%	16.66%	5.56%	0.00%	100.00%
PCA	5.46%	12.04%	9.36%	0.00%	100.00%
GCE	7.11%	17.34%	5.87%	0.00%	100.00%
PTO	7.47%	17.29%	6.20%	0.00%	100.00%
Portfolio Total	*5.2624%*	*3.61%*	*100.00%*		
Return to Risk Ratio	*1.4559*				

Exhibit X : Asset Allocation Optimization Model of Diversified Portfolio ETFs with assigned unequal investments to all Diversified Portfolio ETFs after optimization.

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