ANALYTICS INVESTMENT ADVISORS, LLC

Momentum Investing with Exchange Traded Funds – Recap & Update

"A body in motion stays in motion"
"Truth is to be found in simplicity and not in multiplicity and confusion"
Isaac Newton

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What?

- Momentum investment strategies are well established in the academic literature, which refer to a general class of strategies in which past returns can predict future returns[1]
- The Efficient Market Hypothesis (EMH) flourished across academia in the 1960s and 1970s with proponents arguing that since asset prices reflect all publically available information, investors could not consistently outperform a randomly selected basket of securities after controlling for risk[2].
- The term *momentum* was created by Mark Carhart who published his University of Chicago dissertation in the *The Journal of Finance* (1997)[3], which summarized the relative strength stock selection strategies outlined by Jegadeesh and Tillman. This unleashed a torrent of research on momentum strategies, causing the original architect of the EMH, Eugene Fama, to anoint momentum as the "premier anomaly".
- This new paradigm mirrored the EMH, but relaxed the assumptions regarding investor rationality and frictionless markets in order to better understand why prices might not be efficient.
- While growth and value investing are dependent on economic fundamentals and risk adjusted returns, momentum investing relies only on relative performance, which is independent of returns. As Gray and Vogel point out, "...from a performance and sustainability perspective, momentum investing is more similar to value than growth investing".[4] The question thus becomes: what quantitative models can potentially be constructed to measure momentum to predict the impact on future returns of Exchange Traded Funds (ETFs)? The following paragraphs address this challenge, and discuss the design and results of several quantitative models fashioned with that object in mind.
- The commentary "Momentum Investing with Exchange Traded Funds" dated July 3, 2018, (published at www.AnalyticsLLC.net) relied on a data base constructed from ETFScreen[5] for the one

[1] See for example: Narasimhan Jegadeesh and Sheridan Titman ,"Return to Buying Winners and Selling Losers: Implications for Stock Market Efficiency," *The Journal of Finance* 48 (1993), 65-91; and, Wesley R. Gray and Jack Vogel, *Quantitative Momentum – A Practitioners Guide to Building a Momentum-Based Stock Selection System, John Wiley & Sons, 2016, 54-58.*

[2] Burton Malkiel, *A Random Walk Down Wall Street, (New York: Norton, 1973).*

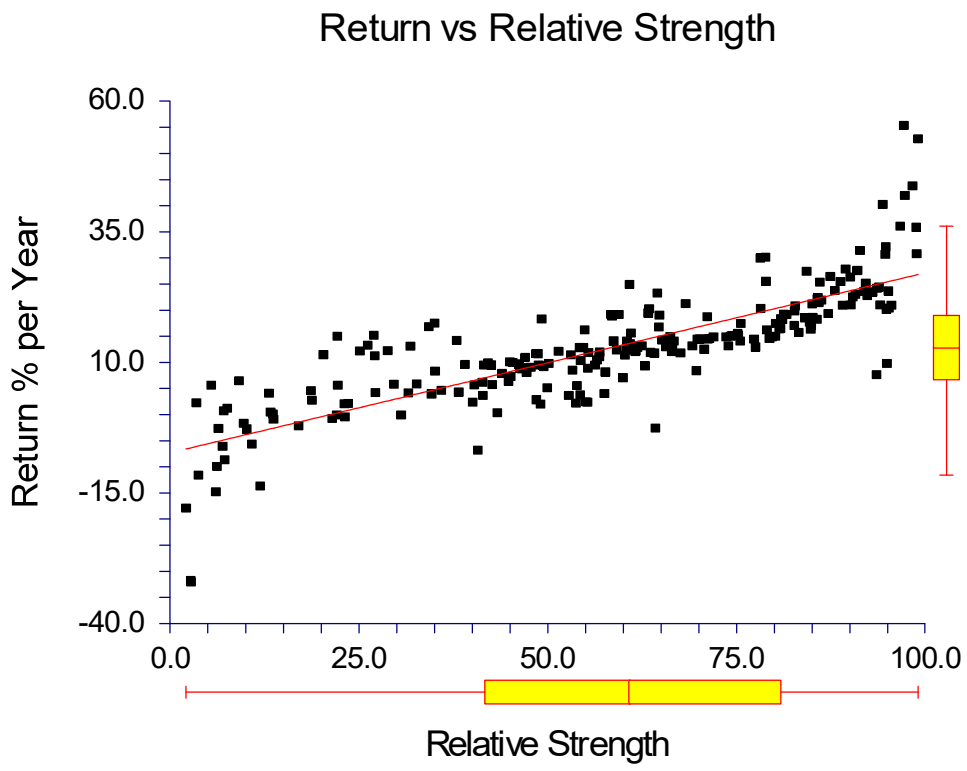
[3] Mark Carhart, "On Persistence in Mutual Fund Performance", *The Journal of Finance, 52, (1997), 57-82.*

[4] Gray and Vogel, op. cit., p.58. "Unlike value which is a strategy that works when traded relatively infrequently, momentum is a strategy that requires a higher degree of trading frequency to be effective."

[5] https://www.etfscreen.com.

year period between May 31, 2017 and May 31, 2018.[6] Of the total 1,232 ETFs captured, which did not include leveraged ETFs, the 10 largest ETFs accounted for 50% of the 12 month dollar trading volume, whereas 301 ETFs with trading volume greater than 9 million shares represented 96% of all trading volume.

- Removing incomplete observations resulted in a sample of 232 ETFs which became the data base for a simple regression model to measure the Return elasticity with respect to Relative Strength; i.e., the percentage change in Return for each 1% change in Relative Strength.



Return = -7.317 + Relative Strength x .344
(-6.498) (20.968)

- The Relative Strength regression coefficient .334 was a statistically significant, while the model explained 65.7% of the equation variability (R^2 =.657). Other attendant statistics are listed below.
- Extrapolating the percentage increase in Returns for a 1% increase in Relative Strength from the Mean (58.5%) to 90%, assuming a .344% Return elasticity, is 10.68% (3.2 x 10 x.334).

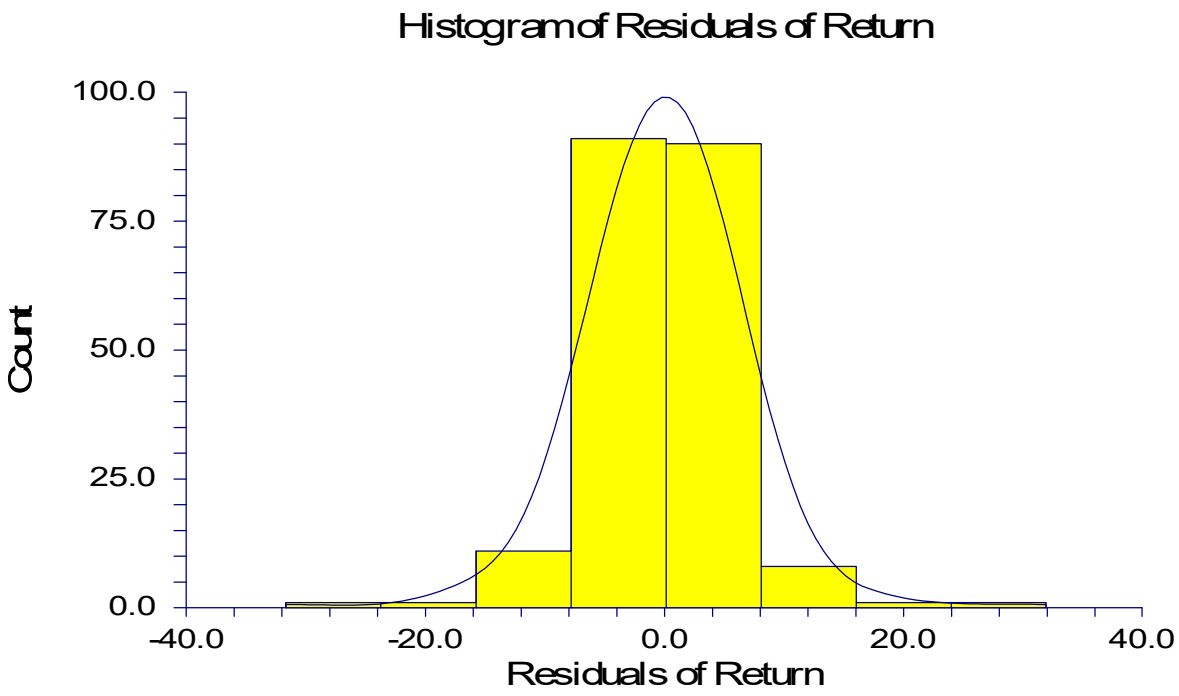
	Return	Relative Strength
Mean	12.8245	58.505
Standard Deviation	11.1922	26.342
Minimum	-32.030	2.11
Maximum	55.350	99.110

[6] Gray and Vogel, op. cit., pp.81-88. Of the three "look-back windows' tested, 1 months (short), 60 months (long) and 12 months (intermediate), the latter was used determined to be the most efficacious.

- The academic consensus and research across different markets and asset classes suggest that momentum and value are driven by a combination of systematic risk factors (a justified reason for higher returns) and an element of mispricing (an unwarranted reason for higher expected returns) Given that: 1) value and momentum strategies are fundamentally risky, 2) investors suffer from behavioral bias, and 3) large scale arbitrage is costly and difficult, a value and momentum stratagem is a logical and efficacious combination.[7]
- In an attempt to analyze the interrelationship of returns, momentum and value, a second data base was constructed from ETFScreen for the one year period ending October 5, 2018 for the same ETFs contained in the previous July 3, 2018 sample, with the exception that P/E values were added as a value indicator for each of the same 232 ETFs.[8] Missing data, however reduced the sample sizes to 204 for Equation #1 and 189 for Equation #2 and #3.

			B0				B1		
Equation #1	Return =		-14.040	+	RS	x	0.358		
	(t-value)		-16.103				26.201		
	Mean	6.061			56.106				
	Std Dev	12.378			30.368				
	Min	-45.46			0.710				
	Max	53.07			98.060				
	N	204							
	R2	0.773							
			B0				B1		
Equation #2	PE =		12.066	+	RS	x	0.123		
	(t-value)		14.481				9.406		
	Mean	18.970			56.310				
	Std Dev	6.532			30.151				
	Min	6.54			0.710				
	Max	43.88			97.020				
	N	189							
	R2	0.322							
					B1				B2
Equation #3	Return =		RS	x	0.314	+	PE	x	-0.579
	(t-value)				22.547				-12.73
	Mean	5.850	55.306				18.412		
	Std Dev	9.067	27.110				4.940		
	Min	-45.46	0.710				6.540		
	Max	40.98	97.020				43.880		
	N	189							
	R2	0.832							

[7] Gray and Vogel, op. cit., 58.
[8] Source: Charles Schwab Institutional.



- Equation #1 is identical in form to the linear regression equation generated in July 2018 in that the dependent and independent are the same; Return and Relative Strength. The regression coefficient for Relative Strength in the present case is .358%, which compares favorably to the earlier estimate of .344%. The percent of Return explained by Relative Strength is 77.3% (R^2=.773), and the residuals of Return are normally distributed as shown above, a necessary condition for unbiased estimation.
- Equation #2 represents an independent measure of the correlation between Value (P/E) and Relative Strength, which is shown to be .567; consistent with Gray and Vogel estimates.[9] This relatively low correlation is in part the justification for combining Value and Relative Strength, along with the sustainable criteria of: 1) exploiting systematic errors; and, 2) having a long investment horizon.[10]
- Equation #3 includes P/E as a second independent variable to Relative Strength. Both regression coefficients are statistically significant; .314 for Relative Strength and -.579 for P/E. The negative regression coefficient for P/E ratios indicates that Returns decline with higher P/E ratios, the expected outcome.
- Extrapolating from the Mean Relative Strength of 55.3% in the multiple regression model (Equation #3) to 90% generates improved Return performance of 11% (.314 x 10 x 3.5).
- The Coefficient of Determination for Equation #3 is R^2=.832, but this parameter is only .059 greater than the *simpler* linear model (R^2=.773), suggesting that while these variables are complementary, models using only value as an independent variable can benefit much more dramatically than the other way around.

[9] Gray and Vogel, op. cit., Table 4 and 5, p.70.
[10] Gray and Vogel, op. cit., p. 35

Why?

- Combining the merits of momentum and value potentially creates a portfolio for investors to beat passive market-capitalization weighted indices over longer periods of time because they both have two requirements for sustainable performance: 1) a process that exploits systematic investor expectations errors; and, 2) an investor's long-term horizon and willingness to be different.
- Absent the value component, as the following section demonstrates, Relative Strength is both necessary and sufficient to construct efficient ETF portfolios which, by definition, maximize risk return relationships, e.g., Sharpe Ratio.

How?

- **Macroeconomic Analysis:** Sound portfolio construction begins with an in depth understanding of U.S. and world macroeconomics. Analyze Aggregate Demand (consumption, retail sales, housing, capital and durable goods, government and trade), Aggregate Supply (manufacturing and production, capacity utilization, productivity, Inventories, and employment), and Determinants (gross domestic product, corporate profits, leading indicators, inflation and interest rates) in terms how they relate to the Business Cycle (early expansion, middle expansion, late expansion, early contraction and late contraction), and accordingly which sectors are likely to perform best in each milieu.
- **Relative Strength:** Given the significant statistical relationship between Return and Relative Strength demonstrated above, it would seem to make sense to begin to develop efficient portfolios by first examining ETFs with high Relative Strength.
- **Establish Benchmarks and Optimal Allocations:** Establish an accurate and familiar benchmark (S&P500, for example) for the strategic allocations under consideration, but also create "optimal" allocation models through the use of Risk/Return Scatter Plots simulations to identify "Low Return High Risk" ETFs for potential elimination or modification to improve volatility and Risk/Return Ratios.[11]
- **Volume and Liquidity:** Since the null hypothesis for "21 day trading volume" was not rejected when added to the multiple regression analysis described above, it is reasonable to assume that ETFs of that magnitude (10million or more) are not effected by lack of liquidity, and thus propitious.
- **Use Graphing Techniques: G**raphing price performance of individual and groups of ETF can be very helpful at any stage and is highly recommended in the context of the technical nature of market movement.[12]
- **Repeat Repeatedly:** Constructing efficient passive ETF portfolios generating high returns for a predetermined level of risk, through diversification and efficient implementation, requires active vigilance and replication of the above principles to insure desirable outcomes, associated with good portfolio management.

[11] AIA, LLC utilizes Morningstar Advisor Workstation (MAW) subscription for this purpose. The MAW Stock Intersection Report capability for the top 50 equities in each portfolio is also a useful capability to better understand the degree and specificity of portfolio diversification.

[12] Wagner, Deron, *Trading ETFs, Gaining an Edge with Technical Analysis,* Bloomberg Press, New York, 2008.

Performance Summary

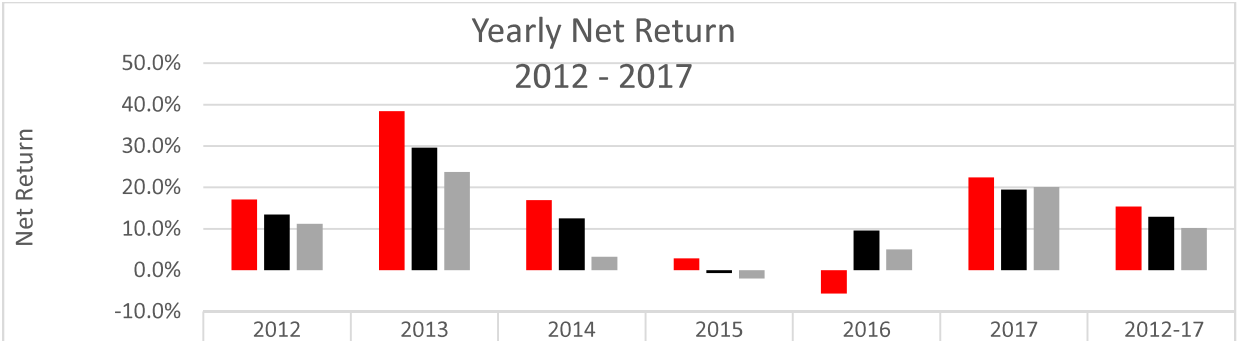
- **Cautious Strategy**: Cautious investors seeking better than nominal returns, but with low risk and emphasis on preservation of wealth (Risk Score: 111-200).
- **Moderate Strategy:** Prudent investors desiring a portfolio designed to accomplish medium to long term financial goals and an investment strategy which accounts for taxes and inflation. Calculated risk is acceptable to achieve good returns (Risk Score: 201-290).
- **Assertive Strategies 1 & 2:** Assertive investors with sufficient income to invest mostly for capital growth. Higher volatility, moderate risk, and more aggressive investments are acceptable to accumulate wealth over time (Risk Score: 291-390).
- **Aggressive Strategy:** Aggressive investors intending to compromise portfolio balance in pursuit of higher long term returns. Security of capital is secondary to potential wealth accumulation (Risk Score: 391-450).

	2012-2017 Avg.*	YTD* 9/30/2018	%AUM	Beta	R2	SD	Sharpe** Ratio
S&P500	**12.87%**	**8.99%**					
Barclay US TR	**2.48%**	**-1.60%**					
Cautious	9.88%	6.72%	1	.91	93	8.97	1.40
Moderate	12.81%	10.16%	13	1.09	86	11.21	1.52
Assertive 1	15.34%	12.14%	56	1.28	91	12.83	1.57
Assertive 2	20.13%	16.75%	10	1.55	89	15.68	1.66
Aggressive	22.58%	23.44%	20	2.28	87	23.26	1.58

*Net Average Return, Portfolio Center, Schwab Portfolio Technologies. Returns are negotiable and range between 50 and 125 basis points.

** Risk Statistics, Morningstar Advisor Workstation; most recent 5 years, computed quarterly.

Beta	Expected change in portfolio return per 1% change in market index return.
R^2	Percent of variation in regression equation explained by the independent variable (S&P500).
SD	Standard deviation of the dependent variable (Net Return).
Sharpe Ratio	Reward-to-Variability Ratio; i.e., portfolio return above risk free rate of return divided by standard deviation (RVAR).



	2012	2013	2014	2015	2016	2017	2012-17
Assertive 1	17.1%	38.4%	16.9%	2.9%	-5.6%	22.4%	15.3%
S&P 500	13.4%	29.6%	12.6%	-0.7%	9.5%	19.5%	12.9%
MSCI World	11.2%	23.7%	3.2%	-2.0%	5.0%	20.1%	10.2%

Efficient Asset Allocation Worksheet

	Benchmark	Cautious	Moderate	Assertive 1	Assertive 2	Aggressive
	S&P 500	5 Year Optimal Performance				
Beta		0.65	1.03	1.15	1.58	2.31
5 Year Average Return	14.52	9.45	17.41	21.33	26.61	37.60
Standard Deviation	9.59	6.34	10.02	12.41	16.37	24.07
Sharpe Ratio	1.51	1.43	1.74	1.74	1.69	1.69
R2		98	97	78	86	85
% Asset Under Mgmt		1%	13%	56%	10%	20%

Efficient Asset Allocation Matrix

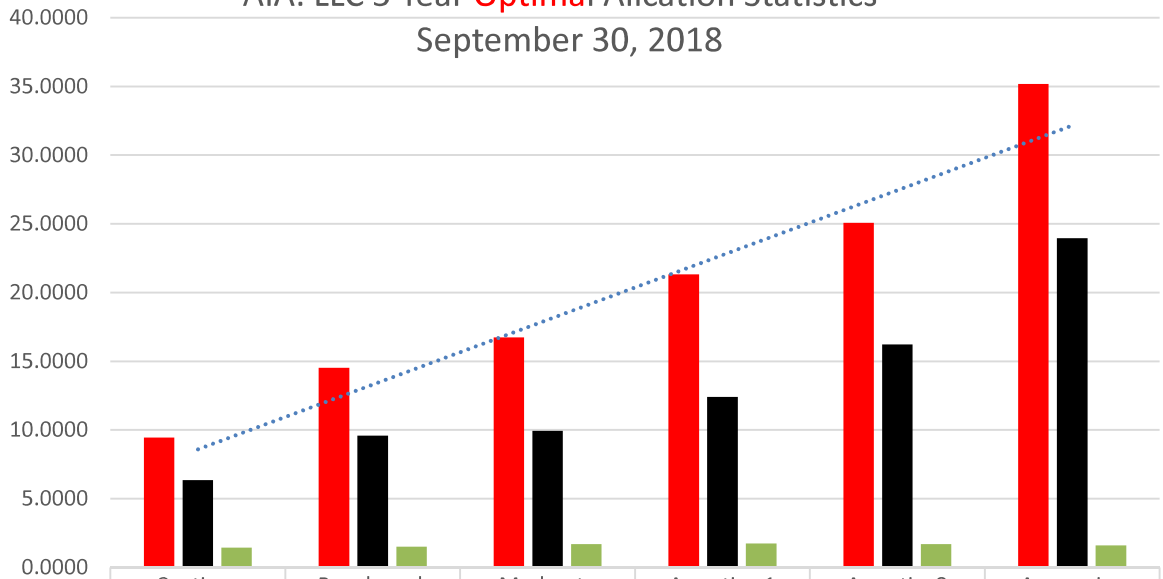
	%AUM	1%	13%	56%	10%	20%
ETF	RS 9/30	Cautious	Moderate	Assertive 1	Assertive 2	Aggressive
FLOT - Floating Bond	45	33.3%				
VYM - High Dividend	68	33.3%				
SPY - SPDR S&P 500	86	33.3%	50.0%			
QQQ - Investco QQQ	93		12.5%	50.0%		
IHI - Medical Devices	97		12.5%	12.5%	15.0%	
ITA - Aerospace	92		12.5%	12.5%	15.0%	
XLY - Consumer Discr.	94		12.5%	12.5%	15.0%	
XBI - Biotechnolgy	71			12.5%	15.0%	
QLD - Ultra QQQ	99				20.0%	75.0%
SSO - Ultra S&P 500	96				20.0%	25.0%
	Total	100%	100%	100%	100%	100%

% AUM		Beta	5 Yr Return	Std Deviation	Sharpe Ratio	R2
Cautious	Optimal	0.65	9.45	6.34	1.43	98
1%	Actual	0.91	12.71	8.97	1.40	93
Moderate	Optimal	1.02	16.74	9.93	1.68	97
13%	Actual	1.09	16.98	11.21	1.52	86
Assertive 1	Optimal	1.15	21.33	12.41	1.74	78
56%	Actual	1.28	19.74	12.83	1.57	91
Assertive 2	Optimal	1.57	25.08	16.23	1.69	86
10%	Actual	1.55	25.30	15.68	1.66	89
Aggressive	Optimal	2.31	35.19	23.96	1.59	85
20%	Actual	2.28	34.02	23.26	1.58	87

Chart 1

AIA. LLC 5 Year Optimal Allcation Statistics*

September 30, 2018

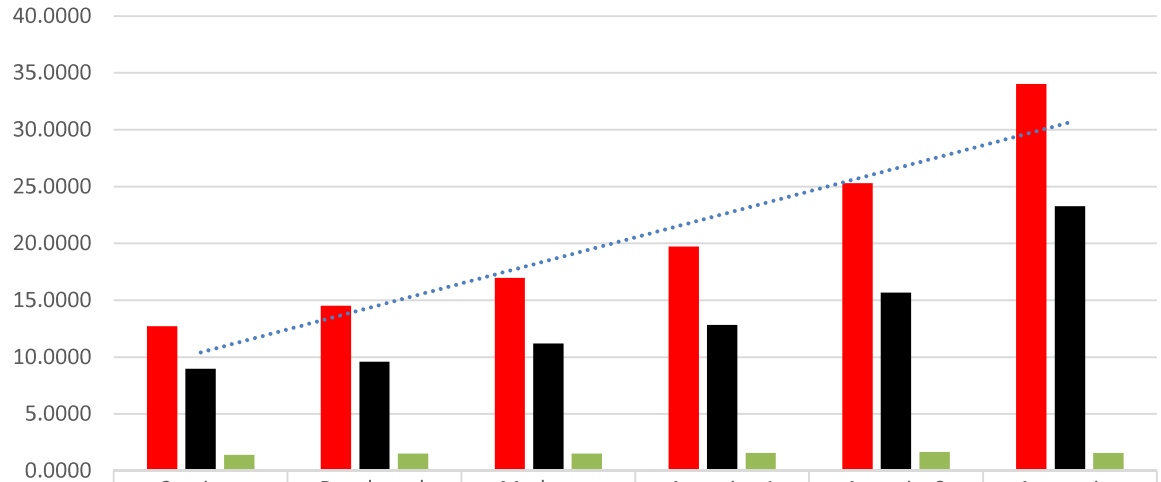


	Cautious	Benchmark	Moderate	Assertive 1	Assertive2	Aggressive
Annual Return	9.4500	14.5200	16.7400	21.3300	25.0800	35.1900
Std. Dev.	6.3400	9.5900	9.9300	12.4100	16.2300	23.9600
Sharpe Ratio	1.4300	1.5100	1.6800	1.7400	1.6900	1.5900

Chart 2

AIA, LLC 5 Year Actual Allocation Statistics*

September 30, 2018



	Cautious	Benchmark	Moderate	Assertive 1	Assertive2	Aggressive
Annual Return	12.7100	14.5200	16.9800	19.7400	25.3000	34.0200
Std. Dev.	8.9700	9.5900	11.2100	12.8300	15.6800	23.2600
Sharpe Ratio	1.4000	1.5100	1.5200	1.5700	1.6600	1.5800

*Source: Morningstar Advisor Workstation.