ENSEMBLE ACTIVE MANAGEMENT

THE NEXT EVOLUTION IN INVESTMENT MANAGEMENT

SEPTEMBER 2018

I. Executive Summary

This White Paper questions the superiority of the traditional Active Management paradigm. Do stand-alone, 'single-expert' investment managers or management teams, with well-defined yet rigidly entrenched philosophies and methodologies, deliver optimal results? The conclusion, derived from a database reflecting 30,000 test portfolios and 165 million data points, was that they do not.

> ***A new approach to investment management, referred to as "Ensemble Active Management" and representing the intersection of Artificial Intelligence and traditional Active Management, was proven the superior option.***

Some of the most compelling data supporting this conclusion can be seen in **Table 1** below. It shows the summary results of rolling 1-year and 3-year time periods comparing Ensemble Active Management Portfolios ("**EAM Portfolios**") to traditional Actively Managed funds (shown as "Fund Clusters"), and to the S&P 500. The analysis covered the period July 2007 to December 2017. In this analysis, the EAM Portfolios were adjusted to reflect a simulated net of fee returns (see *Section VI. Data Analysis and Implications* for details).

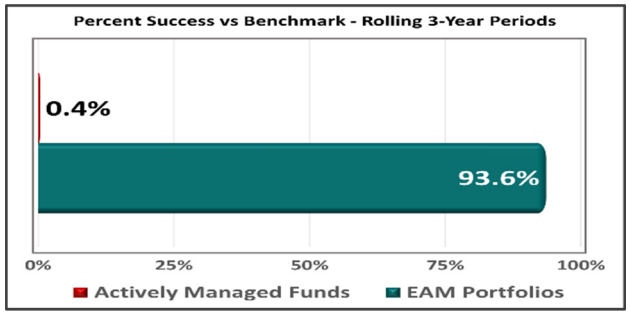
Table 1. Probability of Outperformance and Annual Excess Relative Returns

Rolling 1-Year Periods	% of Time Outperformed	Annualized Excess Return	Rolling 3-Year Periods	% of Time Outperformed	Annualized Excess Return
EAM Portfolios vs S&P 500 Index	72.3%	3.4% (340 bp)	EAM Portfolios vs S&P 500 Index	93.6%	3.80% (380 bp)
EAM Portfolios vs Corresponding Fund Clusters	82.3%	3.3% (330 bp)	EAM Portfolios vs Corresponding Fund Clusters	94.9%	3.6% (360 bp)

Key conclusions to be drawn from **Table 1** include:

- EAM Portfolios ***outperformed the S&P 500 72% of the time***, over rolling 1-year periods, with an average annual ***excess return of* 3.4% *(340 basis points)***;
- EAM Portfolios **achieved a *94% success rate versus the S&P 500*** for rolling 3-year periods, with an average annual ***excess return of* 3.8% (380 basis points);**
- EAM Portfolios ***outperformed traditional Active Management 82% of the time*** over rolling 1-year periods, and ***95% of the time*** for rolling 3-year periods.

For comparison, the fund rating firm Morningstar provides data allowing direct comparison of actively managed mutual funds vs their corresponding index funds, by investment category. For rolling 3-year periods (January 2008 to December 2017) the average Large Cap active fund outperformed the average Large Cap passive fund ***only one time out of 255 rolling periods, or 0.4% of the time*** (see bar chart to the right). On average, actively managed funds ***underperformed by -1.6% (-160 basis points) per annum***[1].



This data would compare to ***EAM Portfolios' 93.6% success rate vs the S&P 500*** (right-hand side, top row of **Table 1)**.

SUMMARY BACKGROUND:

There is no question that stand-alone managers or management teams have been the *de facto* paradigm for delivering Active Management for at least half a century. Yet, there is now a decade's worth of empirical evidence showing that traditional Active Managers have failed to reliably deliver on their mandate of outperforming the market after fees (see prior page, and *Section III, Traditional Active Managers' Glass Ceiling*).

This White Paper tests the viability of a new approach to Active Management, **Ensemble Active Management**, which is the result of traditional Active Management being 're-imagined' through the insights of technologists.

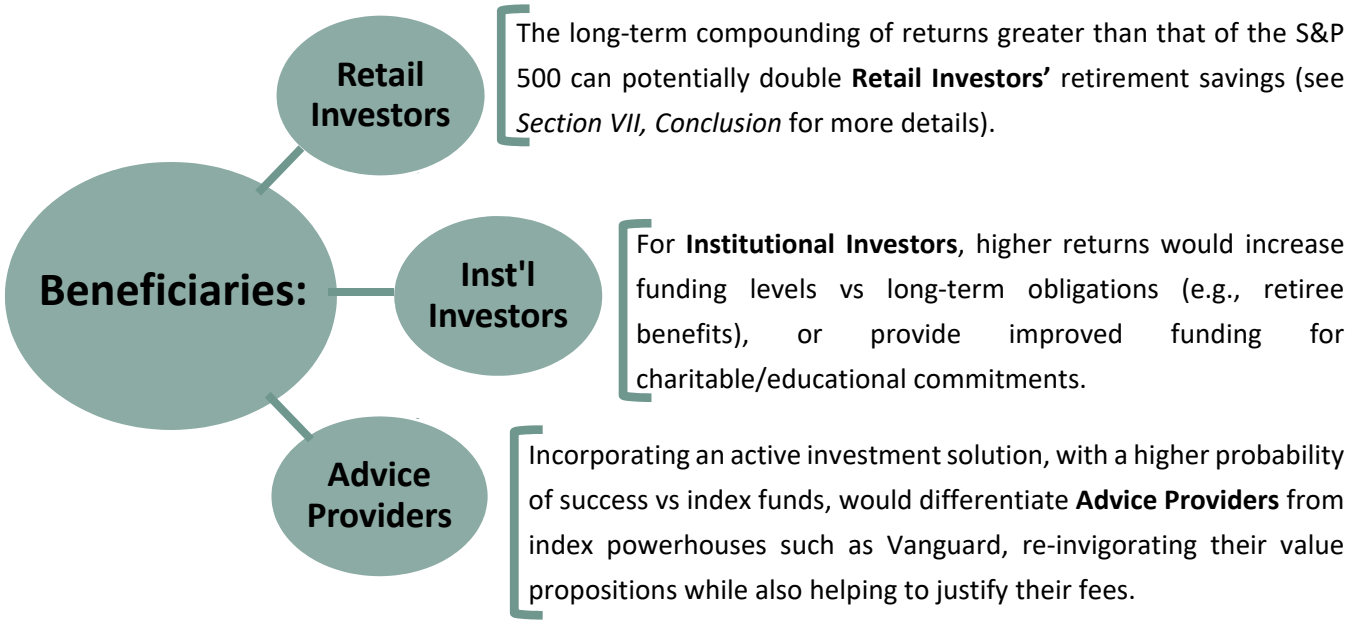
Ensemble Active Management is built upon proven Artificial Intelligence techniques and technologies (primarily "Ensemble Methods") that have been successfully used within other industries for decades, and deploys a multi-expert approach, vs the single-expert paradigm of traditional Active Management.

Ensemble Methods emerged several decades ago as a solution to improving the accuracy of predictive algorithms that had reached a point of diminishing improvement (i.e., hit a 'glass ceiling'). The breakthrough was the realization that if you could not improve a single, predictive algorithm beyond a certain threshold, you could improve results by **linking multiple, independent predictive algorithms and look for consensus or near-consensus agreement between them.** Ensemble Methods generate 'multi-expert' predictive systems, which have been proven to be superior to stand-alone 'single-expert' predictors. In their groundbreaking book *Ensemble Methods in Data Mining*[2], Giovanni Seni and John Elder defined Ensemble Methods as:

"the most influential development in . . . [Artificial Intelligence] in the past decade. They combine multiple [predictive] models into one [that is] usually more accurate than the best of its components."

Technology firms have been successfully using Ensemble Methods to improve predictive accuracy in applications as varied as self-driving cars, weather forecasting, computer security, medicine, and even wine selection[3, 4, 5, 6, 7].

The broader implications of Ensemble Active Management can be profound. If it proves true that investors can reliably achieve returns exceeding that of the S&P 500, then the beneficiaries would include:



The long-term compounding of returns greater than that of the S&P 500 can potentially double **Retail Investors'** retirement savings (see *Section VII, Conclusion* for more details).

For **Institutional Investors**, higher returns would increase funding levels vs long-term obligations (e.g., retiree benefits), or provide improved funding for charitable/educational commitments.

Incorporating an active investment solution, with a higher probability of success vs index funds, would differentiate **Advice Providers** from index powerhouses such as Vanguard, re-invigorating their value propositions while also helping to justify their fees.