AN INTRODUCTION TO ADAPTIVE STRATEGIES

by CataMetrics

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Contents

Adaptive Strategies provide investors with investment portfolios which aim to outperform benchmarks along the capital market line. The investment portfolios are designed for investors who do not employ leverage and are constructed with Exchange Traded Funds (ETFs).

The strategies are adaptive because the construction of the portfolios relies on inputs which describe the contemporaneous market environment—as market conditions change, the forecasts change. The forecasting inherent in the Adaptive Strategies is essentially that we expect markets in the near future to behave similarly to how they behave currently.

The risk and return properties of the individual market indices which make up the strategies' benchmarks, and the ETFs which make up the investment universe, are estimated on the level of the individual market indices and ETFs. A distinct benefit of this approach is that the forecasts for these risk assets, that is, the market indices and ETFs, are estimated within a unified and consistent framework which spans equities, bonds, and commodities, passive and active investment styles, and also includes liquid alternatives and investment strategies which straddle asset classes. Each risk asset is characterized by risks and returns attributable to common market factors and to returns which are specific to that particular risk asset. Each risk asset, therefore, is described by its market sensitivities and by an asset-specific alpha term.

The investment portfolios of each Adaptive Strategy are constructed to provide an optimal balance between the expected excess returns of an investment portfolio relative its strategy benchmark while controlling for the risk of the investment portfolio underperforming the strategy benchmark. Conceptually, this is akin to optimizing a portfolio's Sortino ratio with respect to its benchmark while ensuring that there is a reasonable match between the market exposures of the portfolio and those of its benchmark.

Strategy Definitions

Strategy Definitions and their Benchmarks

There are four Adaptive Strategies each of which is defined by a strategy benchmark.

The strategy benchmarks attempt to represent points along the straight segment of the capital market line to the left of, and including, the global market portfolio, and higher-risk portfolios on the curved segment of the investment envelope to the right of the global market portfolio. Investors who do not employ leverage cannot attain points on the capital market line to the right of the global market portfolio so, therefore, investors who seek benchmarks with higher risks and expected returns than are offered by the global market portfolio are confined by the curvature of the investment envelope. For a detailed discussion of the capital market line and the investment envelope, see our whitepaper "An Introduction to Structured Strategies by CataMetrics."

The investible universe of the Adaptive Strategies consists of six broad asset classes with three of the asset classes covering domestic and international equities and three encompassing domestic and international bonds.

The strategy benchmarks are constructed using a transparent scheme for giving different weightings to each asset class. The strategy benchmarks are re-weighted quarterly to reflect changes in the market capitalizations of their constituent market indices as well as any changes in the selection of market indices.

The strategies and their benchmarks are defined as:

Strategy	Strategy Benchmark Definition	Rationale
Adaptive Global Market Portfolio	The weight of each asset class is defined by the relative market caps of its constituent market indices yielding the global market portfolio	This is the point on the capital market line where a fully-invested, un-leveraged investor achieves the maximum expected Sharpe ratio
Adaptive Moderate Growth	The market caps of the equity asset classes are increased by 40% relative to the Adaptive Global Market Portfolio strategy, thus increasing the effective relative weights of equities	Seeking to emulate a point on the investment envelope which has both higher risk and expected return than has the global market portfolio
Adaptive Growth	Similar to the Adaptive Moderate Growth strategy except that the market caps of the equity asset classes are increased by 80% relative to the Adaptive Global Market Portfolio strategy	Seeking to emulate a point on the investment envelope which has even higher risk and expected return than has the Adaptive Moderate Growth strategy
Adaptive Defensive	The weight of the global market portfolio is scaled back by one quarter with the freed-up allocations assigned to cash	A point on the capital market line which is one quarter less risky than the global market portfolio

Asset Classes

The six asset classes of the Adaptive Strategies are based on combinations of market indices that represent underlying asset which are accessible to a US retail investor investing in ETFs.

The asset-class definitions are:

Asset Classes and their Constituent Market Indices[1]

US Equities	
US large cap	Russell Top 200 Index
US mid cap	Russell Midcap Index
US small cap	Russell 2000 Index
International Developed-Market Equities	
European developed	FTSE Developed Europe Index
Canada	FTSE Canada All Cap Index
Asia ex Japan	FTSE Developed Asia Pacific ex Japan Index
Japan	FTSE Japan Index
Emerging-Market Equities	
Europe	FTSE Emerging Europe All Cap Index
Latin America	FTSE Emerging Latin America Index
Asia Pacific	FTSE Emerging Asia Pacific Index
US Bonds	
US broad investment grade	S&P U.S. Aggregate Bond Index
US inflation linked	S&P U.S. TIPS Index
US high yield by domestic issuers	S&P U.S. High Yield Corporate Bond Index
International Developed-Market Bonds	
Developed treasury bonds ex UST	S&P/Citigroup International Treasury Bond ex-U.S. Index
Developed USD denominated investment grade corporate bonds by foreign issuers	S&P U.S. Foreign Issued Investment Grade Corporate Bond Index
Developed non-USD denominated investment grade corporate bonds by foreign issuers	S&P International Corporate Bond Index
Developed USD denominated high yield by foreign issuers	S&P U.S. Foreign Issued High Yield Corporate Bond Index
Emerging-Market Bonds	
Emerging market USD denominated investment grade and high yield	Bloomberg USD Emerging Market Composite Bond Index
Emerging market local currency Treasury bonds	Bloomberg Emerging Market Local Currency Sovereign Bond Index

The definitions of the asset classes are in the same vein as how we constructed the asset classes of the CataMetrics Structured Strategies but there are some differences in the underlying assets that we aim to capture. For example, in contrast to the Structured Strategies, the Adaptive Strategies do not attempt to reflect un-listed private equity[2] and real estate not investible via listed securities such as REITs, insurance companies, and property companies.[3] The forecasting and portfolio construction of the Adaptive Strategies require quarterly observations of the market caps of the market indices which make up the six asset classes and this information is not available with the necessary frequency for un-listed private equity.

The CataMetrics Investment Committee revisits periodically the selection of market indices which define the strategy benchmarks.

[1] There are many indices available for defining the liquid investible universe and for the sakes of convenience and materiality we chose to not include certain smaller market-cap geographies such as Africa and the Middle East, and product types such as non-US inflation-linked bonds.

[2] The concept of 'listed private equity' is not an oxymoron but refers to listed companies which invest in private equity such as the constituents of the S&P Listed Private Equity Index. To the extent that the constituents of this and other such indices are included in the three equity asset classes, the Adaptive Strategies somewhat reflect the existence of un-listed private equity though most likely only to a small degree since the total market cap of S&P's index is in the $100 billion range (in early 2016), give or take, whereas some estimates (c.f. "IQ Insights | A Case for Global Diversification: Harnessing the Global Multi-Asset Market Portfolio" published in 2015 by State Street Global Advisors) put the value of private equity globally to be just shy of $4 trillion as of April 30, 2015.

[3] The same publication by State Street Global Advisors that we referenced in footnote 2 also estimates the value of investible real estate globally, over and above what is reflect in listed securities, to be $6 trillion and change.

The Investment Process

The object of the portfolio-construction process is to use ETFs to create investment portfolios with desirable forecast and risk and return properties relative to their respective strategy benchmarks.

Forecasting

Forecasting of asset returns and risks, let alone return correlations, is notoriously difficult and wrought with estimation uncertainties. At the core of every forecasting methodology lie three fundamental issues that an investment manager has to address:

Forecasting consistency What are the sources of the return forecasts and how do we ensure that forecasts are consistent with one another? Are we sure that we use the same underlying fundamental assumptions for forecasting the returns for Japanese government bonds as we do for US small-cap equities? And what are the assumptions that we use for forecasting the returns of bank loans, long-short strategies, and a multi-strategy portfolio?

Length and granularity of estimation periods For lack of a meaningful alternative, all forecasters make the assumption that the future will resemble the recent past to a meaningful degree, at least for the purpose of estimating the correlation matrix of returns. We know that the future sometimes plays out in wholly unpredicted ways but if we are not willing to make this somewhat heroic assumption, we may as well get off the grid and move to a log cabin in darkest Maine.[4]

The issue at stake for us who remain on the grid is how to best select the length and granularity of the historical observations periods. More frequent observations should yield more detailed information about the structure of risks but also increase the noise in our measurements. Do we use monthly, weekly, or daily observations, and do we weight the observations to give more emphasis to more recent observations? And how far back in time do we go to capture data before the data becomes irrelevant?

Consistency of return forecasts and the correlation matrix The most vexing issue in forecasting is to ensure that one's return forecasts are consistent with one's risk measures. Implicit in every set of return forecasts is an assumption of correlations for future returns so combining return forecasts which are made separately from the data used for the risk measures would lead to an inconsistent model with disparate and incongruous elements.

[4] With a large supply of dried beans, a generator, a shotgun, and two German shepherds named Smith and Wesson.

Different forecasters answer these questions differently and it is not always transparent which choices an investment manager has made. The answers to these questions for the Adaptive Strategies lie in how we have constructed our integrated risk and forecasting model.

Integrated risk and forecasting model

On the most fundamental level, the return forecasting driving the Adaptive Strategies is equivalent to forecasting the weather by saying that the weather tomorrow will be similar to what the weather has been in the recent past. Translated into an investment narrative, what we mean is that we believe that since the market environment mostly changes gradually, and can persist for long periods of time, we aim to estimate the return distributions of the strategy benchmarks and the ETFs in the investment universe by emphasizing recent observations. In other words, we aim to determine what portfolios would have delivered the best risk-return trade-off in what we define to be the current market environment.

This means that we aim to construct portfolios which are optimal in the current environment and as the world changes, the strategy benchmarks and our forecasts will change, and our investment portfolios will adapt accordingly. Of course, if the markets were to change in drastic and surprising ways, our portfolios are likely to prove to be less than optimal, but this would also be true for portfolio models in general. Market shocks will always lead to unexpected outcomes in the short term but this does not contradict our belief that Adaptive Strategies will deliver attractive returns over longer time horizons.

Our forecasts of risks and returns are integrated because they all flow from a single market model. This means that there is consistency in the assumptions that govern the return forecasts as well as consistency between these forecasts and the model's risk structure.

The market model of Adaptive Strategies is created in two steps. We first use five years of weekly[5] return data for each investible asset and benchmark index constituent which we modify to reflect recent returns and volatilities. In other words, we change the actual historical return data to synthetic return data which has the statistical properties of what an investor is currently experiencing. It is important to note that this transformation largely preserves the higher moments of the return data, such as the tails of the return distributions, as well as the essence of the historical co-movements of returns.[6]

The second step is the estimation of the market model itself—which is a principal-component model—in which the returns of every risk asset are split into multiple beta return streams and an idiosyncratic return stream. Each ETF, and each of the indices that make up the strategy benchmarks, is thus characterized by multiple

[5] We use weekly returns that run from the close of one Wednesday to the close of the next Wednesday unless one of the Wednesdays is a holiday when we let the period run from/to the most recent business day prior to the Wednesday which is a holiday. Of the days of the week, at least for the investment universe available to a US investor, Wednesdays are encumbered with the fewest market holidays.

Since all implementation assets are priced off the US close, we do not suffer any non-synchroneity in this data capture. We do, however, suffer from not having US close-of-business time-takes when it comes to the international indices that are part of our benchmarks, but there is not much we can do about that other than going from weekly to fortnightly or monthly data, options that we rejected because we value the information that comes from having weekly granularity. This is a problem that every forecaster is faced with who uses non-US index data.

[6] Modifying the historical data series to look like the recent past entails changing the overall return and volatility of each series and this transformation hardly affects the estimates of the return correlations of the data series. While this may not be a common technique in equity modeling, this is a version of a well-tried and trusted method used by fixed-income managers.

market betas combined with a time series of returns specific to each risk asset. This means that within the market model, the specific returns represent a risk asset's alpha, and whatever part of the risk asset's returns which are not alpha, are returns attributed to the market in general.

The beauty of this model is that while we can describe the risk and return components of each risk asset with statistical summary measures, in the portfolio-construction process we can combine the use of these measures with the information that is embedded in the full distributional properties of the return series.

Portfolio construction

Once we have estimated the market model, we can begin constructing the investment portfolios.

The portfolio construction process consists of two steps: The creation of return scenarios and the actual portfolio construction based on these scenarios.

The market model describes the joint probability function of the returns of the constituent indices of the strategy benchmarks and the ETFs over a period, which in this case is a week. Since we do not assume a particular distributional form for any risk asset, this joint probability function is complex and does not lend itself to be modeled analytically. In particular, we make no assumptions that would justify simplifying the model to a mean-variance framework. After all, we are concerned with downside risk in particular and in many time periods downside and upside risks manifest themselves differently.

The way we extract the information of the market model is to create return scenarios by sampling outcomes from the market model. We do so a large number of times in order to create joint outcomes of returns for all assets and indices. Since the market model contains all of the higher moments of the synthetic return histories, the scenarios will reflect these distributional features in a coherent and consistent manner. Put simply, generating these scenarios means that we generate a large number of equally plausible paths forward[7, 8] each of which is consistent with the current market environment.

The final step is now the optimization of the investment portfolios over the simulated yearly returns, creating one investment portfolio for each investment benchmark.

Each investment portfolio is created by balancing delicately three investment objectives: To maximize a portfolio's expected excess return over its strategy benchmark, to minimize the risk and size of the portfolio's underperformance of its strategy benchmark, and to aim for the portfolio to match closely the market exposures of its strategy benchmark.

To summarize, the overall aim is for each investment portfolio to give an investor the market exposures of the investor's chosen strategy benchmark while also giving

[7] Something noteworthy happens when one samples returns from the market model and generates returns for a longer time horizon, which in this case is a year. Since we sample returns from the market model, the weekly returns for a given asset are observations generated from a particular individual distribution over and over again. What thus happens is that if we link 52 weekly observations to create accumulated returns for a year, the Central Limit Theorem kicks in and the distribution of the yearly returns starts to look more or less normal. Whether 52 observations are enough to say that the yearly return distribution for each asset is (log) normal is clearly a function of how skewed and twisted is the distribution of the weekly returns.

If the weekly returns are all looking nicely (log) normal then one can probably justify characterizing the yearly returns as (log) normal but if the weekly returns are generated from a very skewed distribution, one that would represent a turbulent recent past, then the yearly returns would not be (log) normal, meaning that 52 (observations) is not a 'large' number in terms of the Central Limit Theorem.

In conclusion, it is not safe to assume that applying a mean-variance methodology to the yearly returns is a sensible thing to do.

[8] As the yearly returns feel the, more or less strong, effect of the Central Limit Theorem, i.e. as the shape of the yearly return distributions differ from the sampled weekly non-log-normal returns, the return correlations change. This means that we cannot simply assume that the correlations of yearly returns are the same as the correlations of weekly returns and there is no reason to believe that using a smaller number of monthly returns will alleviate this issue. This is a pesky problem which further highlights the inherent dangers of applying a mean-variance framework for the portfolio construction.

the investor the chance to outperform the strategy benchmark with the potential outperformance coming from systematic factor tilts and from the alphas embedded in the returns of the ETFs.

Attractive features

The Adaptive Strategies are transparent in their formulation and the investment portfolios embed three important and attractive features that set these strategies apart from many other portfolio-construction solutions:

1. The portfolio-construction process uses the full distribution of asset returns and does not suffer the informational loss that comes from boiling down the construction process to a mean-variance optimization.

2. The use of the market model in conjunction with the optimization alleviates the need for setting arbitrary upper and lower bounds for the allocations to the individual asset classes. The broad asset-class exposures are managed through the ETFs' multi-factor betas.

3. Non-indexed ETFs such as ETFs investing in liquid alternative strategies are treated consistently with indexed ETFs and there is no need for allocation bands to ETFs that do not fit neatly into an asset-class bucket.

We have a high degree of confidence that the Adaptive Strategies are a significant contribution to the investment community and we believe that investors will benefit from both improved absolute and improved risk-adjusted returns in the longer run.

Selection of Investible Assets

The portfolio construction is only as meaningful as the consistency and quality of the forecasts of the market sensitivities and alphas of the investible assets. A suitable candidate investment vehicle therefore needs to have an investment process which we believe to be repeatable. This does not mean necessarily that we only look at funds with purely mechanistic investment processes but we do seek funds whose investment processes are highly systematic.

An asset's beta returns themselves are neither positive nor negative from an evaluation point of view because from the viewpoint of the market model, the cost of beta is in terms of an asset's alpha. For assets that aim to replicate market indices, we would expect most of an asset's overall returns to be attributable to beta returns and have an alpha which is modestly negative. Correspondingly, for assets with significantly positive alpha, we would expect these assets to have a much smaller component of beta returns. In practice, attractive funds are found on a continuum between high beta content and high positive alpha content.[9] Of course, there also exist funds which do not qualify on either account and we try and avoid these.

The key to successful portfolio construction is thus the ability to balance combinations of ETFs so that an investment portfolio as a whole represents an optimal combination of matching the beta requirements of the strategy's benchmark while having a positive expected excess return relative to the strategy benchmark. The desirability of an investment portfolio's expected excess return, however, has to be judged not only by the level of the expected excess return but also by how much cushion the expected excess return provides for the investment portfolio against underperforming its strategy benchmark.

Alphas and betas, however, are not the only selection criteria because we also have to consider transactions costs and the practical implications of data availability.

Transactions costs

To be meaningful as an investible asset, we require a fund to have low transactions costs so that any portfolio rebalancing will not be overly costly.

Low transactions costs for ETFs means a tight bid-offer spread as well as a sufficiently large daily volume to accommodate new investments, exits from the Adaptive Strategies, and portfolio rebalancing. Tight bid-offer spreads for ETFs tend to go hand-in-hand with large AUMs but a large AUM in itself is not a requirement, only that the volumes are large and spreads tight.

[9] Expense ratios of ETFs are only indirectly part of the selection process. Since the portfolio-construction process concerns itself with net returns only, and that allocations are done at the EFT level directly, rather than indirectly via the asset-asset class level as might be the case with a traditional core-satellite methodology where investment vehicles are selected to satisfy the asset-class allocations, the expense ratio is not a selection criterion.

Of course, to the extent that a high expense ratio leads to an unattractive alpha, consideration of fees and cost is implicit in the analysis.

Length of history

Adaptive Strategies use 5+ years of data for the estimation of the market model. However, even in cases when an otherwise desirable ETF has a shorter historical record, we are prepared to include this ETF in the investment universe provided that the ETF has been tracking its underlying index closely and we have no reason to believe that it will not continue to do so going forward.

Investment narratives that we like, or not, as may be the case

The attribution of returns to beta and alpha is entirely a function of the market model, the outputs of which enable us to navigate between funds without having to be overly concerned with the descriptive bucket or category with which the fund's manager or a third-party analytics provider has associated a fund.

Paring the output from the market model with the ETFs' investment narratives yields some noteworthy observations. Unsurprisingly, funds that are strictly indexed to market indices tend to have a large part of their returns explained by their market betas and have alphas close to, or slightly below, zero. As the source for positive alpha, strictly within the realm of our market model, we see potential value in liquid alternatives, cross-asset-class strategies, credit funds, and total return funds.

Common to the types of investment styles mentioned above is that they tend to have systematic and quantitative investment processes which improve the possibility of repeatable outcomes. The corollary is that path-dependent investment strategies do not fit the paradigm of our market model since similar market environments by construction do not necessarily yield similar types of exposures. This means that we will avoid leveraged and inverse index funds.

In the world of the Adaptive Strategies, we expect various forms of smart beta to demonstrate a reasonably large attribution to beta returns, that is, to have a significant R-squared, while also having a positive alpha. In common with all strategies that generate desirable alpha, there is uncertainty about the persistence of this alpha. Not all smart beta strategies will work all the time and not all smart beta strategies exploit sustainable characteristics of the structure of the equity markets. This means that over time some smart-beta-like strategies will perform better than others but we believe that due to the systematic nature of the underlying investment processes, this rotation will be both gradual and, for the Adaptive Strategies, measurable and identifiable.

We are thus confident that the Adaptive Strategies will be able to navigate successfully in using smartish-beta strategies.[10]

[10] In an insightful paper by Research Affiliates, Messrs Arnott, Beck, Kalesnik, and West discuss the risks of investors chasing factor returns and the implications of mining for factors that may not be structurally robust ("How Can "Smart Beta" Go Horribly Wrong?", Rob Arnott, Noah Beck, Vitali Kalesnik, and John West, Fundamentals, Research Affiliates, February 2016.)

Also, since we believe that actively-managed funds tend to have less repeatable alpha, we are less likely to include such funds in the eligible universe of investment vehicles. However, despite our preference for systematic investment strategies, we are somewhat agnostic with respect to the power of animal spirits and may occasionally also explore these more traditional, active strategies.

Revisions and Updates

The asset class compositions and weightings, selection of investible assets, and re-estimation of the investment portfolios follow a calendar-quarter cycle. The updated allocations will be published no later than on the first business day each calendar quarter.

Intra quarter, the Investment Committee will track the performance of the portfolio constituents and may choose to substitute an ill-performing asset for another asset from the eligible universe. Typically, such a replacement would not trigger an overall portfolio rebalancing.

The Investment Committee could also decide to rebalance one or several Adaptive Strategy portfolios in the face of dramatic market events.

The Added Value of Adaptive Strategies

No investment strategy works all the time and even if the stars are aligned, in any period pure chance plays a large role in the outcome of any strategy.

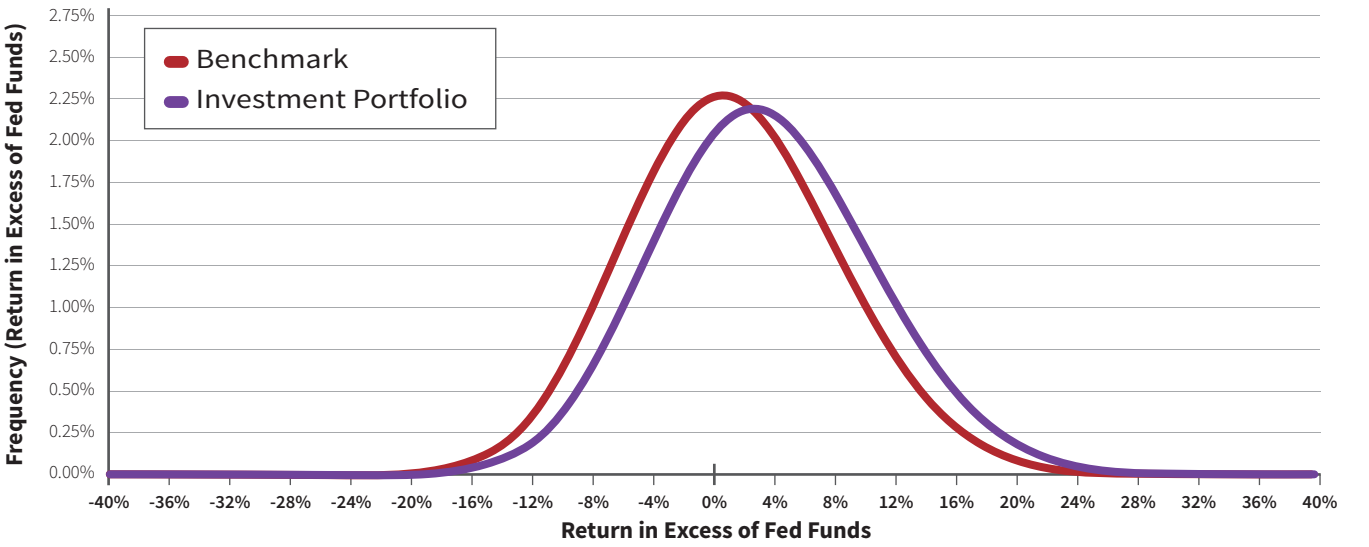
The way to think about the value that Adaptive Strategies generate is to explore the distributions of investment outcomes that the methodology projects. The distributions show the possible outcomes in a particular period and what an investor should strive for is to optimize the chances for excess returns over multiple periods by selecting an investment methodology which tilts the expected value of outperformance to the positive as well as increases the chances of experiencing outperformance in any period. In terms of the distributions of outcomes, this means that the value of the Adaptive Strategies is measured by how the use of the market model and the optimized portfolio construction shifts to the right the expected excess returns over a benchmark.

The diagrams below illustrate the expected differences in returns between the Adaptive Global Market Portfolio strategy benchmark and investment portfolio as of Q2 2016.[11] For the sake of illustrational simplicity we have fitted normal distributions to the discrete, scenario-based outcomes.

Diagram 1 shows the estimated fitted return distributions of the strategy benchmark and the corresponding investment portfolio where both distributions are shown in terms of annualized excess returns above Fed funds. The burgundy graph shows the distribution of the strategy benchmark, i.e. the global market portfolio, and the indigo graph represents the distribution of the investment portfolio.

[11] As we all know so well, past returns are no guarantee of future returns and what has worked in the past may not work in the future.

Diagram 1: Distribution of BM's and Investment Portfolio's Forecast Returns in Excess of Fed Funds



The forecast return distributions for both the global market portfolio and the investment portfolio are both meager and this is consistent with the turbulent and feeble returns that global markets experienced during the more recent past covering most of 2015 and the beginning of 2016. The importance, however, lies in the fact the investment portfolio has an expected return of about 3.2% vs a return expectation of approximately 1.1% for the global market portfolio. For both distributions, the annualized standard deviation around the means is about 7%.

Diagram 2 clearly demonstrates the benefits of the portfolio construction in distributional terms: The differential expected return is explained by the shift of the probability mass of burgundy area from under the distribution of returns for the benchmark to the indigo area under the distribution of returns for the investment portfolio.

Diagram 2: Distribution of BM's and Investment Portfolio's Forecast Returns in Excess of Fed Funds

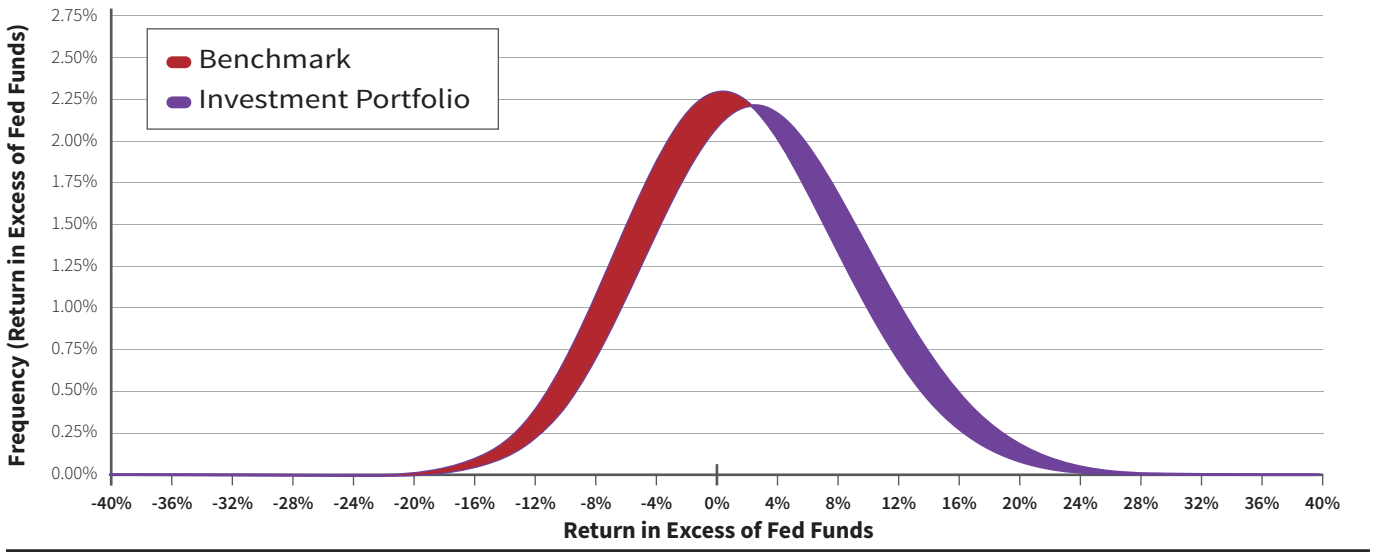


Diagram 3: Distribution of Forecast Investment Portfolio less Benchmark Outcomes

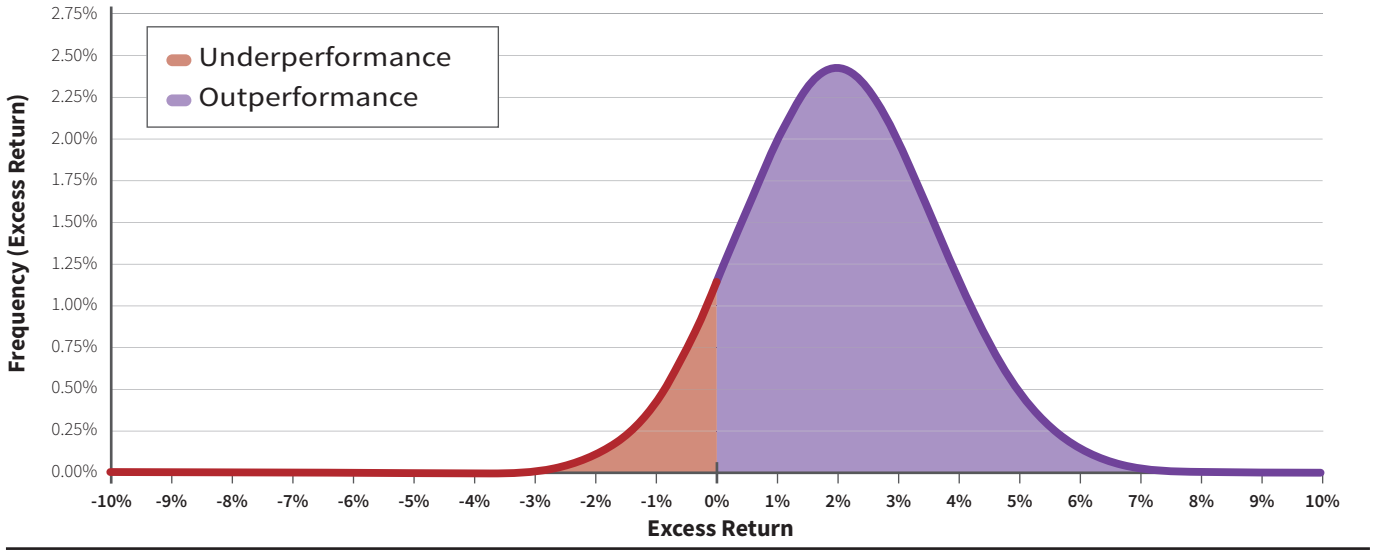


Diagram 3 is based on the same data as *Diagrams 1* and *2* but shows the explicit distribution of the projected annualized excess returns of the investment portfolio over those of the market portfolio. The mean of the stylized distribution is 2.1% (3.2% less 1.1%) and the standard deviation of the outperformance distribution is slightly in excess of 2%.

The area shaded in light-blue represents the investment portfolio's distribution of outperformance of its strategy benchmark, in this case the global market portfolio, and the red-hued area represents underperformance. The size of the outperformance area, and thus the probability of outperformance, is about 90%.

Summary

Adaptive Strategies provide investors with a range of systematic strategies with differing levels of risk and investment objectives.

Every Adaptive strategy is defined by a well-diversified global strategy benchmark and an investment portfolio consisting of cost-effective EFTs. The investment portfolios combine active fund selection with rigorous risk management and seek to take advantage of medium-term opportunities to yield excess returns over their strategy benchmarks.

The portfolio allocations are intuitive with a mix of liquid and low transaction cost index-tracking funds, multi-asset strategies, total-return portfolios, and liquid alternatives. The benchmarks and the investment portfolios are rebalanced quarterly.

Disclosures and Disclaimers

CataMetrics Management

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The Risks of ETFs

Exchange-traded funds (ETFs) are subject to risks similar to those of stocks, such as market, interest rate, foreign exchange, and liquidity risks. An investor in ETFs may bear indirect fees and expenses charged by the ETFs in addition to their direct fees and expenses, and is subject to the risk of loss of principal. ETF sponsors may suspend trading in ETFs and may not honor redemption requests. ETFs may trade at a discount or premium to their net asset value and are subject to the market fluctuations of their underlying investments. When considering investing in an ETF, you should consult your financial advisor and accountant on how investing in the fund will affect your taxes.

Before investing in an ETF, you should read both its summary prospectus and its full prospectus, which provide detailed information on the ETF's investment objective, principal investment strategies, risks, costs, and historical performance (if any). The SEC's EDGAR system, as well as Internet search engines, can help you locate a specific ETF prospectus. You can also find prospectuses on the websites of the financial firms that sponsor a particular ETF, as well as through your broker.

Past performance is no guarantee of future results of any ETF.

CataMetrics®
MANAGEMENT, LLC

55 Greens Farms Road, Suite 200-02, Westport CT, 06880 | 203-680-0330
www.CataMetricsManagement.com