

# Asset Allocation Optimization Using Downside Risk Analysis



# DOWNSIDE RISK ANALYSIS

Designing an optimal portfolio for an individual investor, total retirement plan, or plan participant has undergone dramatic changes over the last few decades. Not yet an exact science, portfolio construction has moved past the “art” phase of its development. Another term for portfolio construction is “asset allocation.” Without proper asset allocation, there is little chance of a successful financial plan because the real rate of investment return will likely be insufficient.

Numerous studies, along with basic intuition, have revealed that asset allocation is a key determinant of investment performance over time. In addition asset allocation is an important tool for reducing risk. Over time, asset allocation can explain most of the investor’s long-term investment return, so it should not be left to chance. Asset allocation is part of the general financial plan success triad, along with asset quality and adequate savings.



Anyone who has had even the slightest exposure to the teachings of investing has heard that determining one’s asset allocation is a most important decision. Generally, the main asset classes under consideration are equities (stocks or stock mutual funds), fixed income (bonds or bond funds), and cash (money market securities). According to the most often quoted study in this area, the allocation of one’s investment dollars between stock, bond and cash asset classes determines 90% of the portfolio’s performance over time. More recent studies report that asset allocation may only explain 40% of total

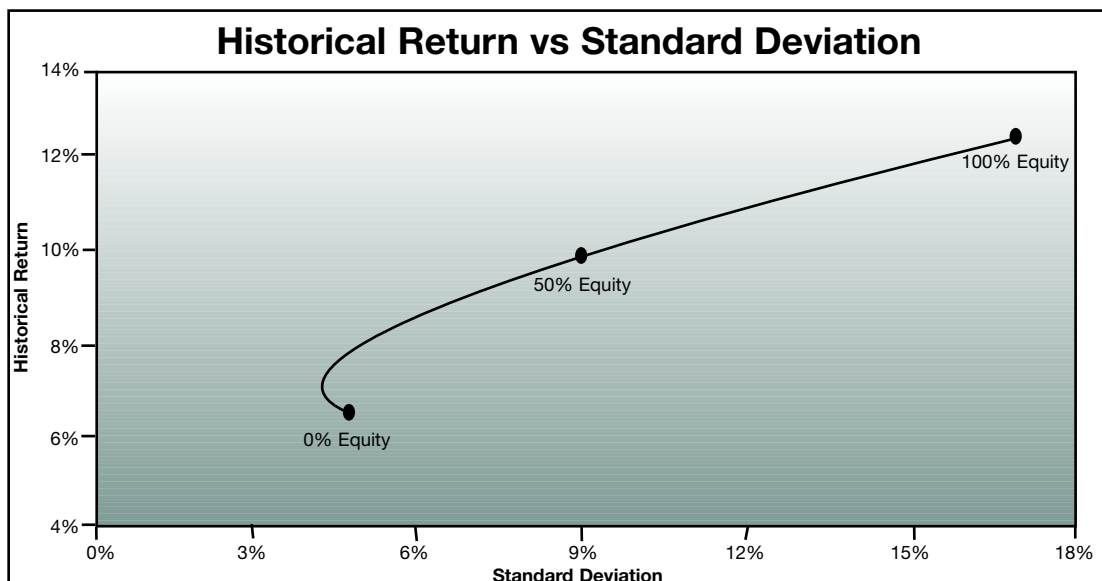
return. But whether the figure is 90% or 40%, there is no doubt that asset allocation explains a substantial portion of return over time.

Asset allocation can protect wealth from the dangers of a volatile market. From the Great Depression of the 1930s to the technology stock bust of the late 1990s, fluctuations in the stock market have plagued investors. Asset allocation allows investors to obtain growth while limiting the chances of huge loss. However, many individual investors and defined contribution plan participants do not understand or apply any type of effective asset-allocation policy. This is a stark contrast to professionally managed defined benefit plans. Virtually every defined benefit plan has a detailed written asset-allocation investment policy managed by specialists.

# MODERN PORTFOLIO THEORY

In defining asset allocation, the terms “risk” and “volatility” are often used, and most investors and assume that there should be less of it. Today the risk of a single asset class or entire portfolio can be measured. What is risk, how do we define it, and what does it have to do with returns? In 1952, Dr. Harry Markowitz published an article in the Journal of Finance that showed the tradeoff between risk and return. The higher the portfolio’s return, the higher the risk—he used standard deviation as a measure of risk. This relationship is called Modern Portfolio Theory.

Markowitz demonstrated the risk-reward relationship on a graph called the “Efficient Frontier,” which plots “return” on the y-axis against “risk” (standard deviation) on the x-axis. Practically speaking, standard deviation measures uncertainty—either good or bad. Markowitz further concluded that the most efficient portfolio was the one that gave the highest return for each level of portfolio risk. An inefficient portfolio exposed the investor to a higher level of risk without a corresponding higher level of return.



Historically, using modern portfolio theory, the easiest way to define risk was using standard deviation of the asset’s return over many time periods. What does this standard deviation calculation actually mean? Standard deviation is a statistical measure of the scatter between groups of return figures. Two thirds of the time the annual return of the asset lies between one standard deviation above and one below the mean value. In addition 95% of the time the return will lie between two standard deviations above and two standard deviations below the mean.

As we will discuss in more detail later in this paper, the problem with this analysis is that standard deviation does not correspond to how an investor views risk. Few investors would be upset if their return was above their expected value, but most would be disappointed if their return was below their expected value. Thus standard deviation is flawed as a measure of risk because it cannot distinguish bad volatility from good volatility.

# **P**OST MODERN PORTFOLIO THEORY

## ***IS THERE A BETTER WAY TO DEFINE RISK?***

In order to create the most optimal asset allocation mixes we must plot return versus risk. Many investors and plan participants think they understand risk; however, risk can be a deceiving concept that varies from case to case. Differing risk-measurement techniques have confused even the most savvy investor. To begin this discussion, we need to review some basic definitions.

### **STANDARD DEVIATION**

The most widely accepted measure of investment risk is standard deviation. When used to gauge performance risk, it measures the degree to which returns have been spread out around their historical average. Most mutual fund reports carry some information about standard deviation, although most people reading it, and many writing about it, don't understand what it means.

Standard deviation is a statistical measurement of dispersion around an average, which, for an investment, depicts how widely the returns varied over a certain period. Investors use the standard deviation of historical performance to try to predict the range of returns that is most likely for a given fund. When a fund has a high standard deviation, the predicted range of performance is wide, implying greater volatility.

For example, a portfolio return of 15% annually over ten years is generally good. But an investment style that returns 15% every year is more valuable than one that is up 100% one year and then down 75% another, even if it also averages 15% over a long period. Most investors prefer a return that meets their financial goals and expectations with the least possible risk. They seek investments with the least variability of return, or annual difference from the expected return. Investors look at returns to gauge the likelihood of future excess performance. Standard deviation measures how consistently that return was delivered. The more consistently a return occurred in the past, the more likely the investor will receive that return in the future.

The main problem with standard deviation is that it is not a measure of risk. Rather, it is a measure of uncertainty. As we will see a bit later in this paper, investors think of risk and uncertainty differently. Any risk measure based upon standard deviation is flawed. Investors worry about not meeting their goals, not about higher-than-expected returns (uncertainty). In addition, skewness and kurtosis in "real world" portfolios with non-normal distributions cause standard deviation to underestimate risk.

### **BETA**

This is another commonly misunderstood risk measurement. Beta does not measure risk. Beta is a measure of a fund's sensitivity to market movements. The beta of the market is 1.00 by definition. Generally, a stock fund is correlated to the S&P 500. If a fund has a beta of 1.50, it tends to move 1.5 times as much in either direction as the S&P 500. For example, if the S&P 500 were up 10%, the fund would be expected to be up 15%. It is a correlation indicator, not a risk indicator.

It is important to note that a low beta for a fund does not necessarily imply that the fund has a low level of volatility. A low beta signifies only that the fund's market-related correlation is low. A specialty fund that invests primarily in gold, for example, will usually have a low beta, as its performance is tied more closely to the price of gold and gold-mining stocks than to the overall stock market. Thus, the specialty fund might fluctuate wildly because of rapid changes in gold prices, but its beta will remain low. The "R squared" general correlation to the overall stock market would be lower than most funds, but the volatility would still be high.

### **ALPHA**

Alpha is a measure of the difference between a fund's actual returns and its expected performance, given its level of risk as measured by beta. A positive alpha figure indicates that the fund has performed better than its beta would predict. In contrast, a negative alpha indicates the fund's underperformance, given the expectations established by the fund's beta. Alpha is a measure of excess return, not risk.

$$\text{Alpha} = \text{Excess Return} - [\text{Beta} \times (\text{Benchmark} - \text{Risk Free Return})]$$

Where **Benchmark** is the total return of the benchmark index and **Beta** is the fund or portfolio manger beta.

### **SHARPE RATIO**

The Sharpe Ratio is risk-adjusted measure developed by Nobel laureate William Sharpe. It is calculated by using standard deviation and Alpha to determine reward per unit of risk. This idea is that the higher the Sharpe Ratio, the better the fund's historical risk-adjusted performance. Various studies have offered mixed reviews as to whether or not the Sharpe Ratio has any future predictive power on fund performance.


$$\text{Sharpe Ratio} = \frac{\text{Portfolio Return} - \text{Risk Free Return}}{\text{Standard Deviation}}$$

Any measurement that uses the standard deviation in the equation, such as the Sharpe Ratio, is a flawed measure of risk. The standard deviation measures uncertainty, not risk the way an investor thinks of risk. Thus any measure that incorporates standard deviation somewhere in the calculation is measuring uncertainty. Investors do not care about good volatility they are only concerned about bad volatility.

# DESCRIBING RISK IN A WAY THAT CORRESPONDS TO INVESTORS' THINKING

As mentioned above, there are drawbacks to using standard deviation as a measure of risk: it interprets any difference from the average, above or below, as bad, not how most investors feel about returns. Few investors fret about their portfolios doubling; most only worry about the downside—their returns being below average. Investors think of risk as downside risk only.

**Typical Investor Risk Hierarchy**



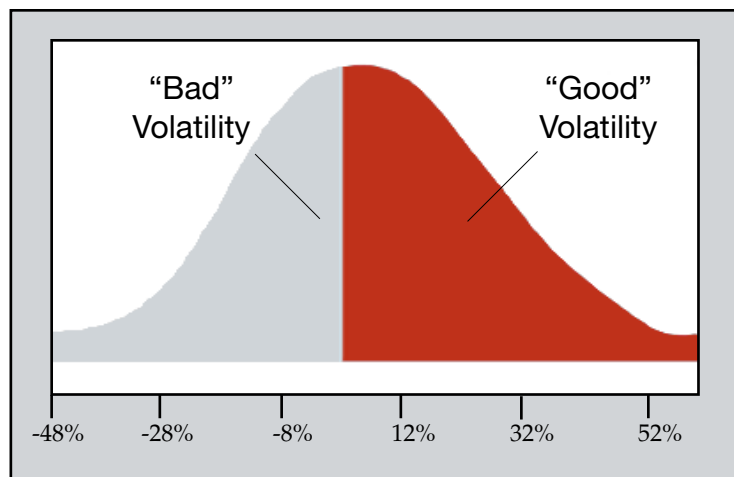
1. Risk of principle loss (returns below zero)
2. Risk of failing to meet one's goals (such as retiring at age 62)
3. Risk of relative underperformance (benchmark such as S&P 500)

Downside risk, as the name implies, measures risk below a certain point. For example, if an investor is worried only about losing money, that point would be zero, and the possibility of negative returns would be viewed as risky. If an investor needs to earn a 7% annual return in order to meet goals, any return under 7% would be considered risky.

If an investor is evaluating a mutual fund against its peer group, any return below the performance of the peer group would be unacceptable. This investment return floor, which serves as the dividing line between good and bad outcomes, is called the Minimum Acceptable Return (MAR).

Unlike standard deviation, downside risk accommodates different views of risk. Institutional investors often view investment risk as the possibility of underperforming the benchmark, whereas retail investors tend to regard risk in absolute terms as the possibility of loss.

Investors can customize the downside risk calculation using their own MAR. The institutional investor typically uses the benchmark rate as the minimum acceptable return, while the retail investor often uses the risk-free rate. Because standard deviation can only measure how tightly distributed returns are situated around a mean, it cannot be customized for individual investors.



The amount of risk in a set of returns changes considerably depending upon where the MAR is set. For example, if one investor needs an investment that returns no less than 4% annually, any amount less than this will result in the underfunding of her pension plan.

Another investor wants a good return but doesn't want to incur losses. By raising the MAR from zero to 4%, a larger amount of the return distribution violates the MAR. This additional area—the amount between zero and 4%—is considered risk for the first investor, but not for the second.

Risk is one of those subjects where there is widespread agreement on the surface but little agreement on the details. Many plan sponsors and investors agree that they do not like risk, but they often disagree on just how much risk is involved in a particular investment. Downside risk can accommodate this diversity in risk perception. Downside risk measures risk below some point. If an investor is worried only about losing money, the possibility of negative returns would be viewed as risky. If an investor needs to earn  $x\%$  return to meet goal, any return under  $x\%$  would be unacceptable (risky). This represents the MAR floor that is tolerable for this investor.

The key difference between standard deviation and MAR is as follows: Standard deviation interprets any difference from the average return, above or below, as bad. Most investors' views of risk are toward the downside only. That is, investors only worry about their returns being below some point. In addition to being a more intuitive definition of risk, the major advantage to downside risk over standard deviation is that it accommodates different views of risk.

Institutional investors often view investment risk as the possibility of underperforming the benchmark. Plan participants view risk in absolute terms, as the risk of not accomplishing their goal. By using downside risk, each investor can customize the risk calculation using an individualized MAR. In the above examples the institutional investor would use the benchmark rate as the minimum acceptable return, while the plan participant would want to know the risk of falling below 7%. Standard deviation can only measure how tightly distributed returns are situated around a mean, so it cannot be customized for the individual investor.

Another limitation to standard deviation as a measurement of investment risk lies with the underlying data. Most investors will recall the "normal distribution" from their Introduction to Statistics course. This nicely proportioned bell-shaped curve is what underlies all the assumptions about standard deviation. If the underlying data is not normally distributed, the standard deviation is likely to give misleading results. A number of studies have demonstrated that investment returns are not normally distributed. If the returns are not normally distributed, investors using standard deviation are likely to reach the wrong conclusions.

A further enhancement to the downside risk calculation is by utilizing bootstrapping. Bootstrapping is a technique that tries to increase the explanatory power of a limited amount of data.

Bootstrapping in this case selects twelve months at random and links them together to form a one-year return. This process is repeated thousands of times, resulting in a distribution with many observations instead of just a few. An underlying assumption to bootstrapping is that the data is independent. Most investors believe that the return from one period has something to do with that from another period, but the two values have little correlation. Studies suggest that sequential returns are not entirely independent, but the correlation between a return and that of a return two periods later is approximately zero. One must weigh the additional explanatory power gained by the increased number of observations against the error introduced because returns are not entirely independent. In spite of its possible drawbacks, we prefer to bootstrap data, because we believe that it is able to capture returns that could have happened but never did happen, therefore providing a more complete picture of the nature of uncertainty.

# DOWNSIDE RISK STATISTICS

Downside risk calculations provide the user with more information than just a standard deviation number. The additional statistics provide great insight into the causes of the risk.

**DOWNSIDE DEVIATION RISK** (semi-deviation, or semi-variance below MAR) can be thought of as the equivalent to the standard deviation of just bad results. Similar to the loss standard deviation except the downside deviation considers only returns that fall below a defined (MAR) rather than the arithmetic mean. Generally speaking our research has consistently demonstrated the downside risk will be greater when the MAR is an absolute number, such as 5% annual return, as compared to a relative number such as peer group performance.

**DOWNSIDE PROBABILITY** tells the user how often the returns violated the MAR. This is important, because in order to assess the likelihood of a bad outcome, it is necessary to know how often one occurred. Downside probability answers the question: “Is an investment below the MAR 5% of the time or 50% of the time?” The opposite of downside probability is Upside Probability. Upside probability is how often the investment exceeded the MAR.

**AVERAGE UNDER PERFORMANCE** indicates the average size of the unacceptable returns. This statistic helps an investor judge the severity of the average “bad” return. An investment that lost money twice as often as a second investment may still be preferable if it tended to lose far less than the second investment. Average Under Performance answers the question: “When an investment is below the MAR, is it 2% below or 20% on average?”

**DOWNSIDE MAGNITUDE 99<sup>TH</sup> PERCENTILE** is the return at the ninety-ninth percentile on the downside. This is a worst-case scenario. An investment may lose money only occasionally, may average small losses when they do occur, and yet may prove unacceptable if the potential exists for huge losses. Downside Magnitude 99th Percentile answers the question: “When an investment is below the MAR, what is the worst case scenario?”

**DOWNSIDE MAGNITUDE 99<sup>TH</sup> PERCENTILE AND 75<sup>TH</sup> PERCENTILE** are the returns at the ninety-fifth and seventy-fifth percentile on the downside. This not the “worst-case scenario”, but since they are expected to occur 5% of the time and 25% of the time, they would typically be results that the risk adverse investor must be able to tolerate due to their frequency.

**ACTIVE SORTINO RATIO** The accepted risk-adjusted return measurement is the annualized return of the manager minus the MAR, divided by the downside deviation risk. Similar to the Sharpe Ratio (which uses standard deviation), the Active Sortino Ratio measures how many units of active excess return were received per unit of downside risk experienced. However, it defines risk in a way more like the average investor thinks of risk. A positive ( $> 0$ ) Active Sortino Ratio is good and a negative value ( $< 0$ ) is undesirable.

**DNRISK INDEX<sup>SM</sup>** is a custom blended risk statistic mix to further enhance the predictive power of the various downside risk statistics mentioned above. It attempts to help answer the questions: “Does historical downside risk predict future downside risk?”, and “Does historical downside risk predict future investment performance?”



# EXAMPLE OF DOWNSIDE RISK PORTFOLIO MEASUREMENT AND FIDUCIARY OPTIMIZATION

Let's assume an investor is trying to manage their 401(k) account on their own. They have looked at the various mutual fund portfolios available to them, and decided to put one third of their contribution in a money market account, one third in a small cap blend fund and one third in a large cap growth fund.

- ☞ Is their portfolio asset allocation optimal?
- ☞ How much risk do they face?
- ☞ How would they determine this?

We will compare the current portfolio to a proposed portfolio that is optimized using these techniques.

**CURRENT PORTFOLIO ANALYSIS:** Page 10 illustrates the fiduciary prudence testing of this portfolio. The portfolio fails on all ten of ten fiduciary tests and is not deemed to be prudent. A plan participant utilizing this mix will reduce their likelihood of retirement success.

**PROPOSED PORTFOLIO ANALYSIS:** Pages 11-12 illustrate the fiduciary prudence testing of the proposed portfolio. The portfolio passes on all ten of ten fiduciary tests and is deemed to be prudent. A plan participant utilizing this mix will increase their likelihood of retirement success.

**DOWNSIDE DEVIATION RISK AND DOWNSIDE PROBABILITY:** Pages 13-14 illustrate the downside deviation and downside probability of the two portfolios against a "Benchmark Efficient Frontier" comprised of S&P 500 and Intermediate Govt. Bond asset allocation mixes ranging from 0% equity to 100% equity. The proposed portfolio has much improved return/risk characteristics.

**AVERAGE UNDER PERFORMANCE:** Page 15 illustrates the average size of the unacceptable returns below the MAR of 6.14% (1.50% per quarter). This statistic helps an investor judge the severity of the average "bad" return. Again, the proposed portfolio has much improved return/risk characteristics.

**DOWNSIDE MAGNITUDE 95<sup>TH</sup> PERCENTILE AND 75<sup>TH</sup> PERCENTILE** are shown on pages 16 and 17. These represent the returns at the ninety-fifth and seventy-fifth percentile on the downside. This is not the "worst-case scenario", but since they are expected to occur 5% of the time and 25% of the time, they would typically be results that the risk adverse investor would need to be able to tolerate. Again, the proposed portfolio has much improved return/risk characteristics.

**STANDARD DEVIATION:** Page 18 illustrates the portfolio comparison using the traditional measure of risk.

# CURRENT PORTFOLIO FIDUCIARY REVIEW ASSET ALLOCATION ANALYSIS USING DOWNSIDE DEVIATION RISK OPTIMIZATION

## CURRENT PORTFOLIO:

Curent Non-Optimized Mix

MAR= 6.14%

### FIXED INCOME

|                              |               |
|------------------------------|---------------|
| Cash                         | 33.33%        |
| Stable Value Funds           | 0.00%         |
| Intermediate Term Bonds      | 0.00%         |
| Long Term Bonds              | 0.00%         |
| High Yield Bonds             | <u>0.00%</u>  |
| <b>Subtotal Fixed Income</b> | <b>33.33%</b> |

### STOCKS

|                               |               |
|-------------------------------|---------------|
| Large Cap Growth              | 33.33%        |
| Large Cap Blend               | 0.00%         |
| Large Cap Value               | 0.00%         |
| Mid Cap Growth                | 0.00%         |
| Mid Cap Blend                 | 0.00%         |
| Mid Cap Value                 | 0.00%         |
| Small Cap Growth              | 0.00%         |
| Small Cap Blend               | 33.33%        |
| Small Cap Value               | 0.00%         |
| Real Estate Inv Trusts (REIT) | 0.00%         |
| Foreign Stocks                | 0.00%         |
| Foreign Value Stocks          | <u>0.00%</u>  |
| <b>Subtotal Stocks</b>        | <b>66.66%</b> |

## HISTORICAL DATA

|                                | PORTFOLIO | BENCHMARK | PASS/FAIL   |
|--------------------------------|-----------|-----------|-------------|
| Historical Return              | 10.05%    | 11.24%    | <b>Fail</b> |
| Worst Year 25th Percentile     | 1.72%     | 3.72%     | <b>Fail</b> |
| Downside Deviation Risk        | 6.96%     | 5.37%     | <b>Fail</b> |
| Downside Probability           | 34.70%    | 31.00%    | <b>Fail</b> |
| Return/Downside Deviation Risk | 1.44%     | 2.09%     | <b>Fail</b> |

## ESTIMATED FUTURE RETURN

### MODELED DATA

|                                | PORTFOLIO | BENCHMARK | PASS/FAIL    |
|--------------------------------|-----------|-----------|--------------|
| Estimated Future Return        | 7.91%     | 8.73%     | <b>Fail</b>  |
| Worst Year 25th Percentile     | -0.29%    | 1.34%     | <b>Fail</b>  |
| Downside Deviation Risk        | 7.81%     | 6.33%     | <b>Fail</b>  |
| Downside Probability           | 39.20%    | 38.60%    | <b>Fail</b>  |
| Return/Downside Deviation Risk | 1.01%     | 1.38%     | <b>Fail</b>  |
| <b>Total Passing Scores</b>    |           |           | <b>0.00%</b> |

**OVERALL FIDUCIARY RATING:** Model Requires Additonal Review

A model must pass at least 50% of te ten criteria for prudence, and also outperform the matched historical benchmark consisting of the S&P 500 Index for stocks and the Lehman Intermediate Government Bond Index for fixed income.

# PROPOSED PORTFOLIO FIDUCIARY REVIEW ASSET ALLOCATION ANALYSIS USING DOWNSIDE DEVIATION RISK OPTIMIZATION

## PROPOSED PORTFOLIO:

Proposed Optimized Mix

MAR= 6.14%

### FIXED INCOME

|                              |               |
|------------------------------|---------------|
| Cash                         | 0.00%         |
| Stable Value Funds           | 33.33%        |
| Intermediate Term Bonds      | 0.00%         |
| Long Term Bonds              | 0.00%         |
| High Yield Bonds             | <u>0.00%</u>  |
| <b>Subtotal Fixed Income</b> | <b>33.33%</b> |

### STOCKS

|                               |               |
|-------------------------------|---------------|
| Large Cap Growth              | 4.00%         |
| Large Cap Blend               | 5.33%         |
| Large Cap Value               | 6.67%         |
| Mid Cap Growth                | 2.67%         |
| Mid Cap Blend                 | 13.33%        |
| Mid Cap Value                 | 10.67%        |
| Small Cap Growth              | 0.00%         |
| Small Cap Blend               | 0.00%         |
| Small Cap Value               | 10.67%        |
| Real Estate Inv Trusts (REIT) | 0.00%         |
| Foreign Stocks                | 0.00%         |
| Foreign Value Stocks          | <u>13.33%</u> |
| <b>Subtotal Stocks</b>        | <b>66.67%</b> |

## HISTORICAL DATA

|                                | PORTFOLIO | BENCHMARK | PASS/FAIL |
|--------------------------------|-----------|-----------|-----------|
| Historical Return              | 11.54%    | 11.24%    | Pass      |
| Worst Year 25th Percentile     | 5.30%     | 3.72%     | Pass      |
| Downside Deviation Risk        | 5.23%     | 5.37%     | Pass      |
| Downside Probability           | 27.00%    | 31.00%    | Pass      |
| Return/Downside Deviation Risk | 2.21%     | 2.09%     | Pass      |

## ESTIMATED FUTURE RETURN

### MODELED DATA

|                                | PORTFOLIO | BENCHMARK | PASS/FAIL |
|--------------------------------|-----------|-----------|-----------|
| Estimated Future Return        | 7.91%     | 8.73%     | Pass      |
| Worst Year 25th Percentile     | -0.29%    | 1.34%     | Pass      |
| Downside Deviation Risk        | 7.81%     | 6.33%     | Pass      |
| Downside Probability           | 39.20%    | 38.60%    | Pass      |
| Return/Downside Deviation Risk | 1.01%     | 1.38%     | Pass      |

Total Passing Scores

100.0%

**OVERALL FIDUCIARY RATING:** Prudent Model

A model must pass at least 50% of the ten criteria for prudence, and also outperform the matched historical benchmark consisting of the S&P 500 Index for stocks and the Lehman Intermediate Government Bond Index for fixed income.

# CURRENT VS. PROPOSED PORTFOLIO FIDUCIARY TESTING ASSET ALLOCATION ANALYSIS SUMMARY COMPARISON USING DOWNSIDE DEVIATION RISK OPTIMIZATION

|                                       | CURRENT | PROPOSED | IMPROVEMENT<br>(ABSOLUTE) | IMPROVEMENT<br>(RELATIVE %) |
|---------------------------------------|---------|----------|---------------------------|-----------------------------|
| <b>HISTORICAL DATA</b>                |         |          |                           |                             |
| Historical Return                     | 10.05%  | 11.54%   | 1.50%                     | 14.91%                      |
| Historical Worst Year 25th Percentile | 1.72%   | 5.30%    | 3.58%                     | 207.96%                     |
| Historical Downside Deviation Risk    | 6.96%   | 5.23%    | 1.74%                     | 24.94%                      |
| Historical Downside Probability       | 34.70%  | 27.00%   | 7.70%                     | 22.19%                      |
| Hist. Return/Downside Deviation Risk  | 1.44%   | 2.21%    | 0.77%                     | 53.08%                      |

|                                      |        |        |       |         |
|--------------------------------------|--------|--------|-------|---------|
| <b>ESTIMATED FUTURE</b>              |        |        |       |         |
| Estimated Return                     | 10.05% | 11.54% | 1.50% | 14.91%  |
| Estimated Worst Year 25th Percentile | 1.72%  | 5.30%  | 3.58% | 207.96% |
| Estimated Downside Deviation Risk    | 6.96%  | 5.23%  | 1.74% | 24.94%  |
| Estimated Downside Probability       | 34.70% | 27.00% | 7.70% | 22.19%  |
| Est. Return/Downside Deviation Risk  | 1.44%  | 2.21%  | 0.77% | 53.08%  |

## FIDUCIARY TESTS: HISTORICAL DATA

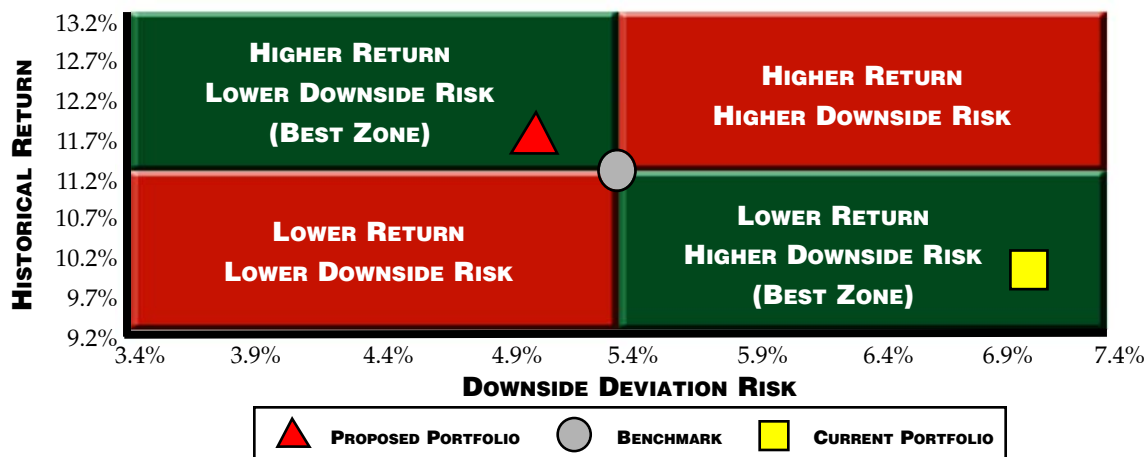
|  |      |      |
|--|------|------|
| 1) Historical Return                         | Fail | Pass |
| 2) Historical Worst Year 25th Percentile     | Fail | Pass |
| 3) Historical Downside Deviation Risk        | Fail | Pass |
| 4) Historical Probability                    | Fail | Pass |
| 5) Historical Return/Downside Deviation Risk | Fail | Pass |

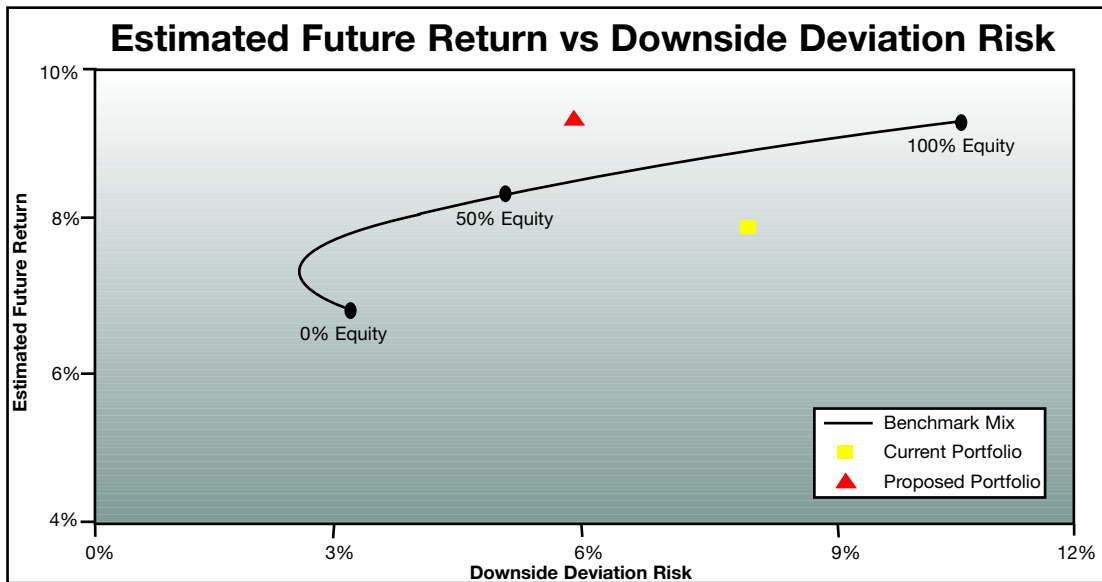
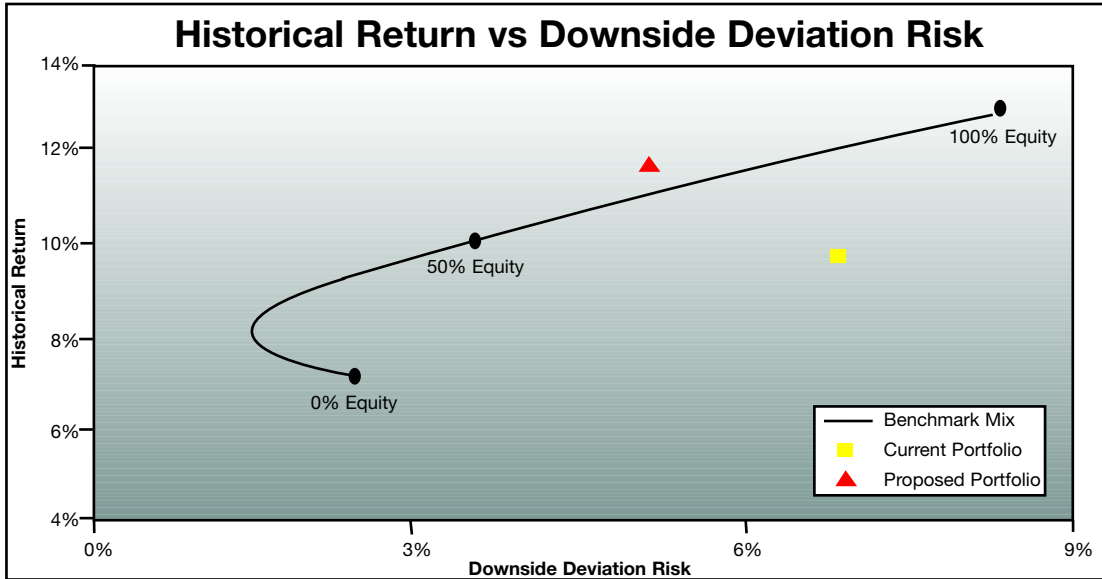
## FIDUCIARY TESTS: ESTIMATED FUTURE

|  |      |      |
|--|------|------|
| 6) Estimated Future Return                   | Fail | Pass |
| 7) Estimated Worst Year 25th Percentile      | Fail | Pass |
| 8) Estimated Downside Deviation Risk         | Fail | Pass |
| 9) Estimated Downside Probability            | Fail | Pass |
| 10) Estimated Return/Downside Deviation Risk | Fail | Pass |

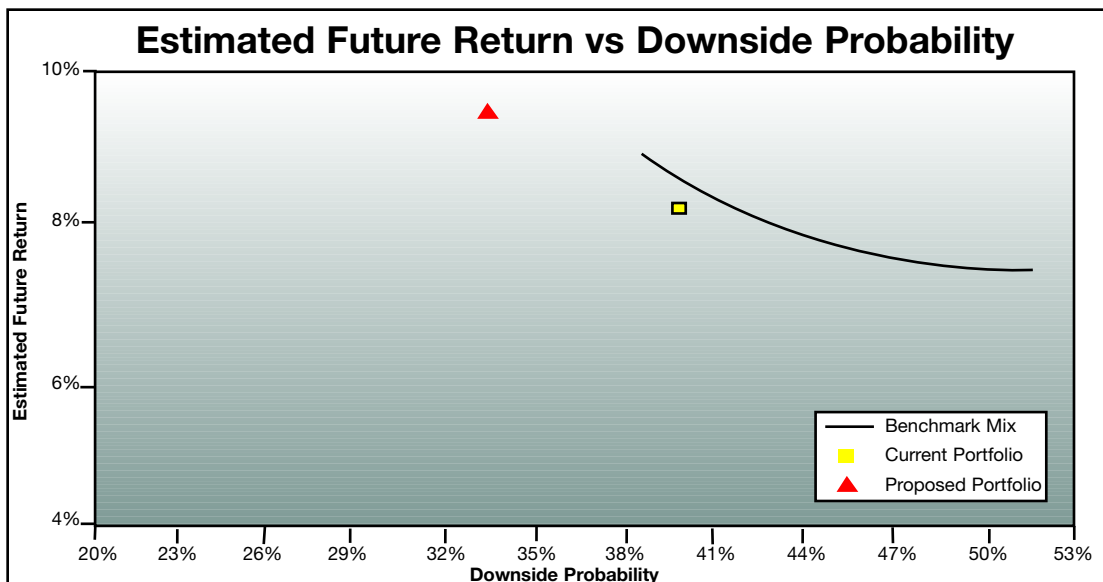
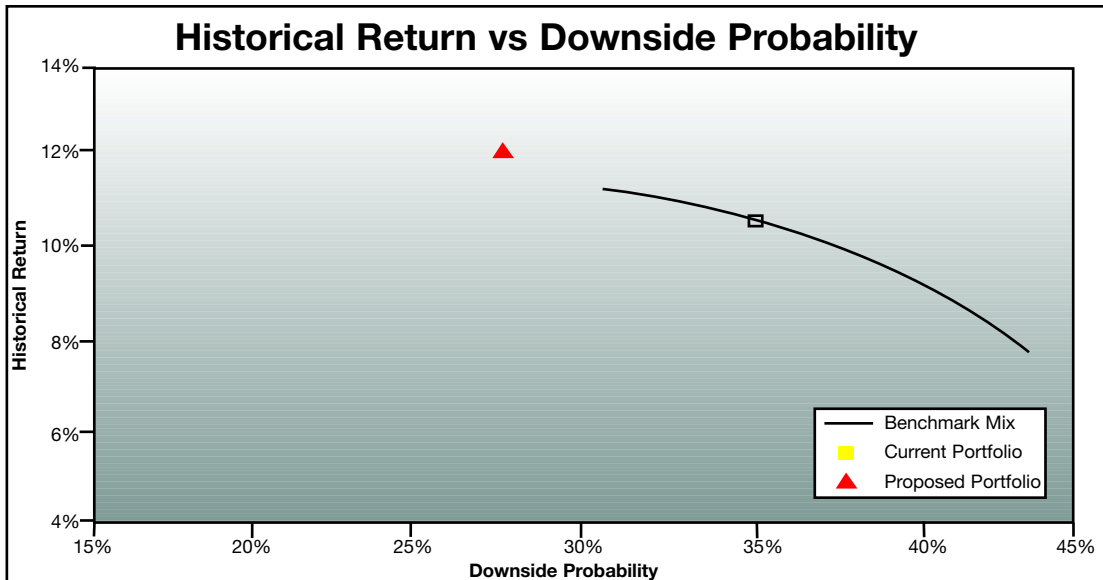
A model must pass at least 50% of the ten criteria for prudence, and also outperform the matched historical benchmark consisting of the S&P 500 Index for stocks and the Lehman Intermediate Government Bond Index for fixed income.

|                      |      |        |
|----------------------|------|--------|
| Total Passing Scores | 0.0% | 100.0% |
|----------------------|------|--------|

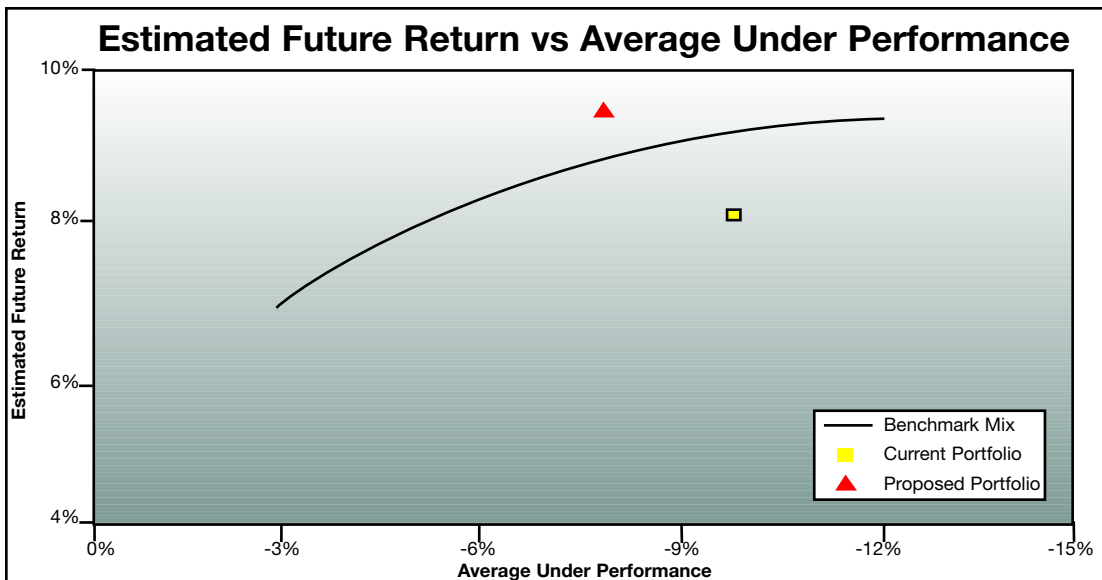
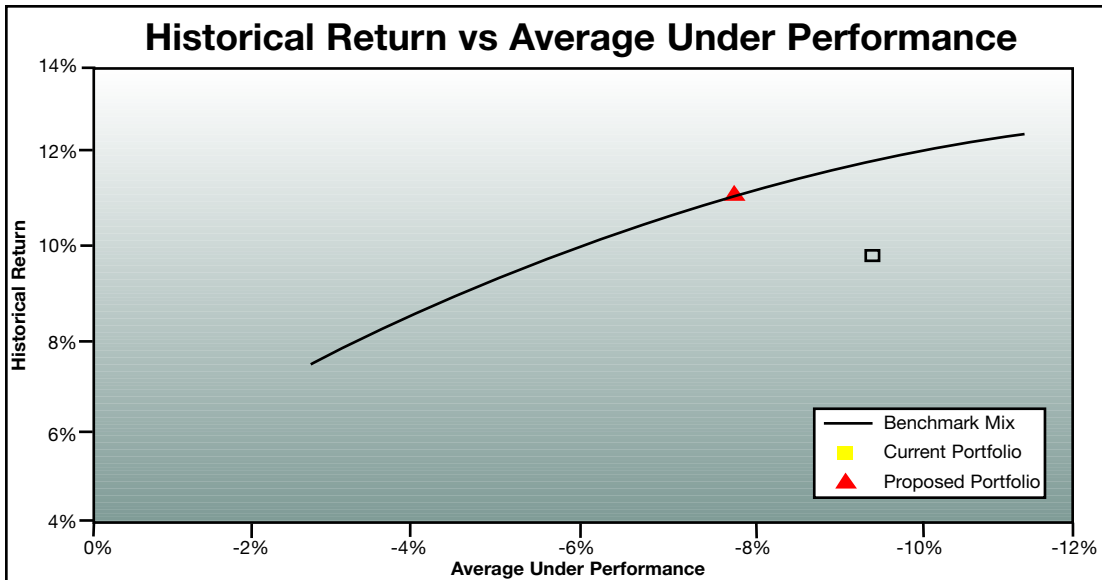




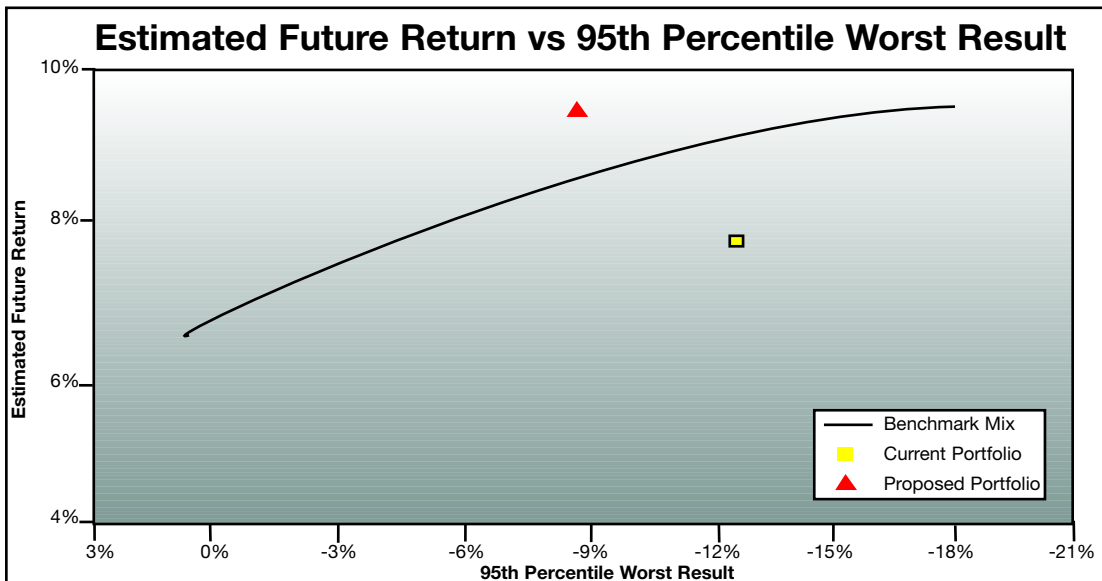
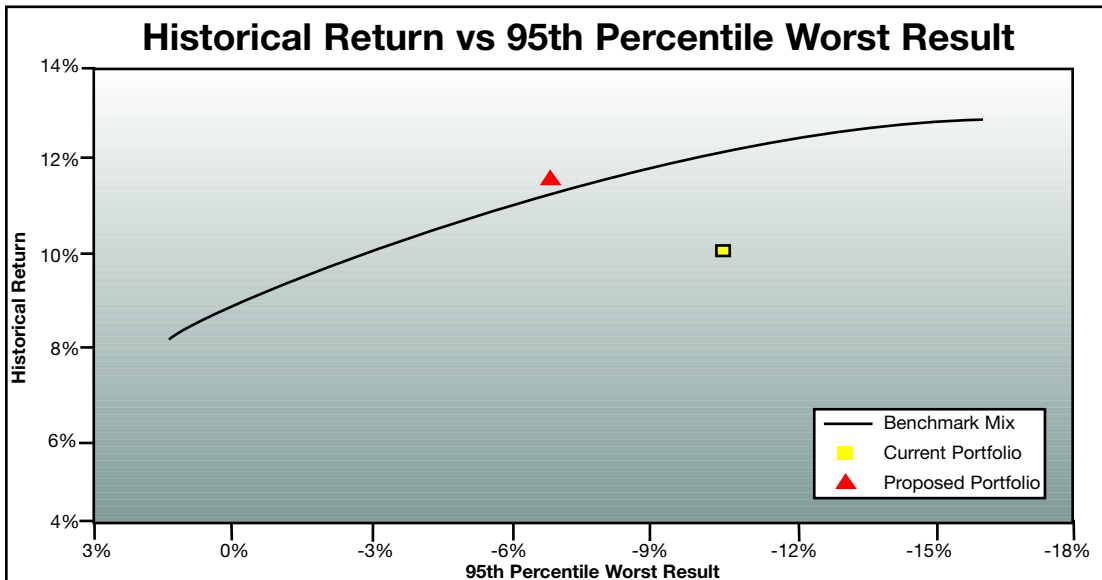
- 1) Data are 87 quarters beginning with the 1st quarter 1985 to and ending with the 3rd quarter 2006.
- 2) Solid black line represents the "Benchmark Efficient Frontier" of S&P 500 and Intermediate Govt. Bond asset allocation mixes ranging from 0% equity to 100% equity.
- 3) Portfolios above and to the left of the Benchmark Efficient Frontier have better return/risk characteristics.
- 4) Portfolios below and to the right of the Benchmark Efficient Frontier have inferior return/risk characteristics.
- 5) Estimated future return reduction based upon interest rates, current economic models, P/E ratios and dividend yields.
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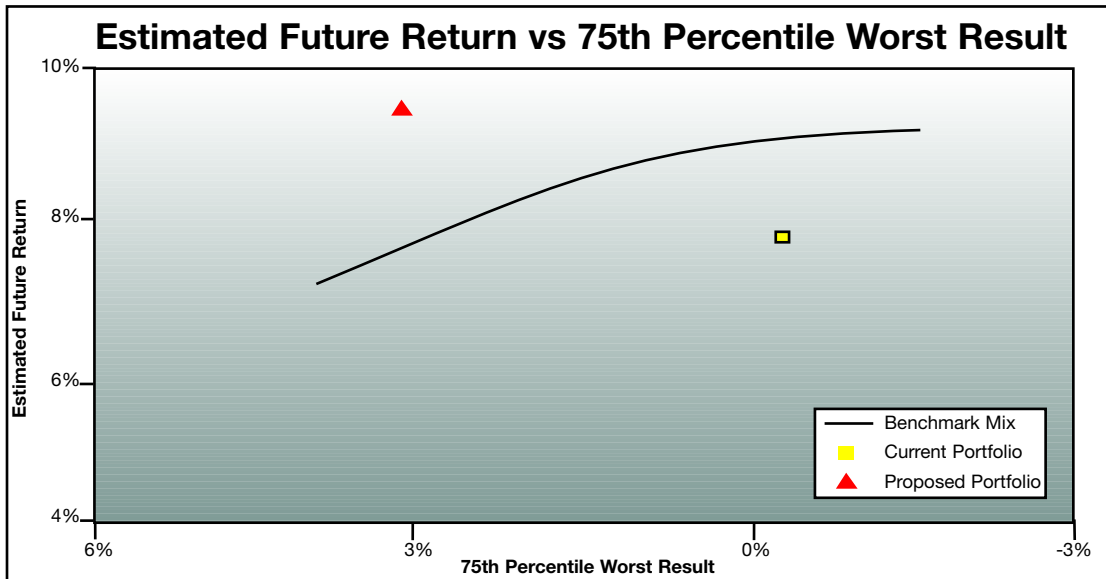
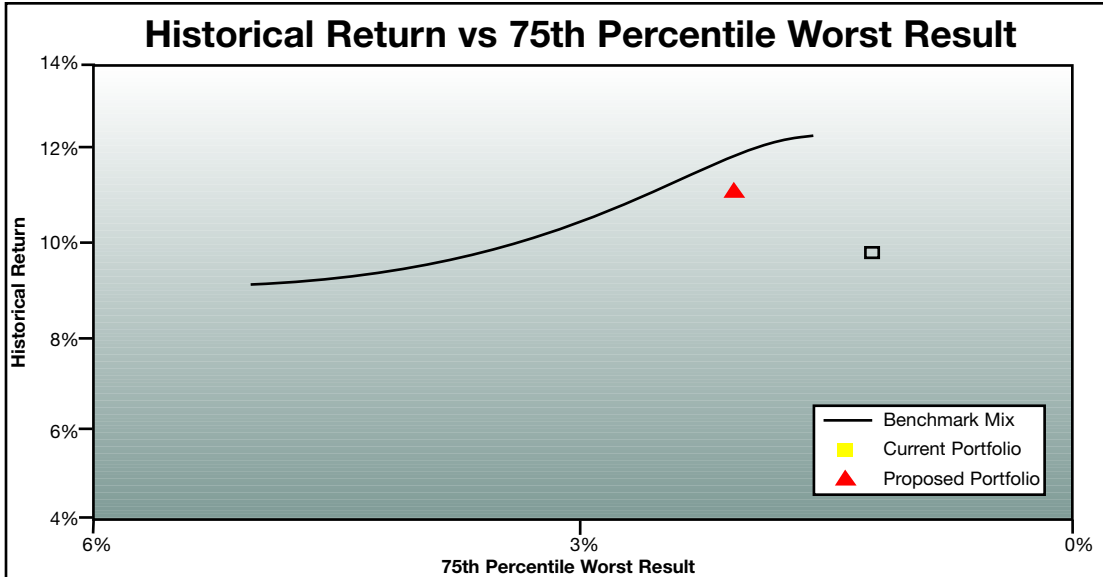


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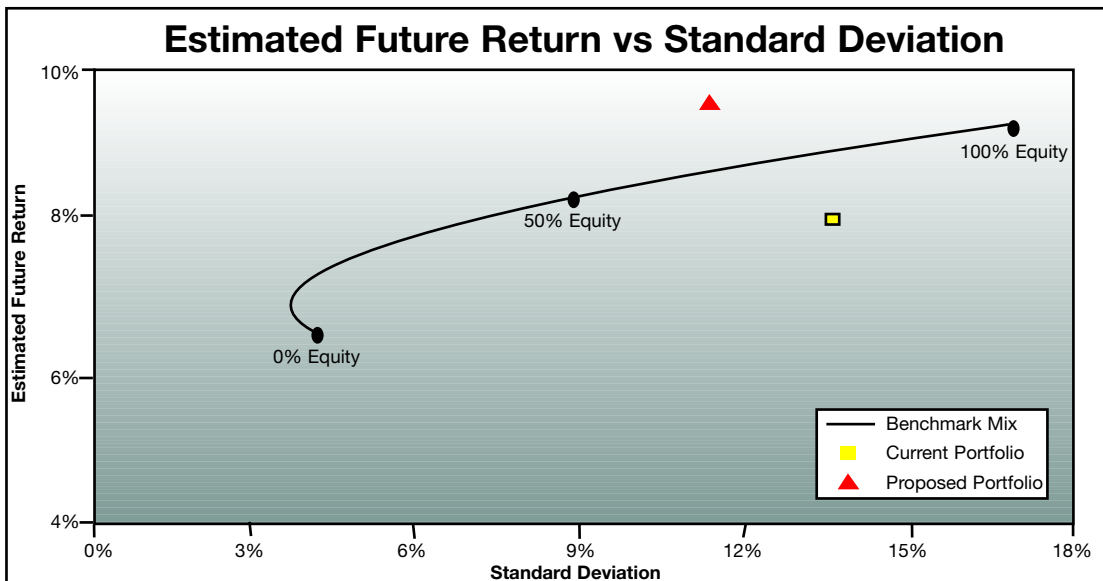
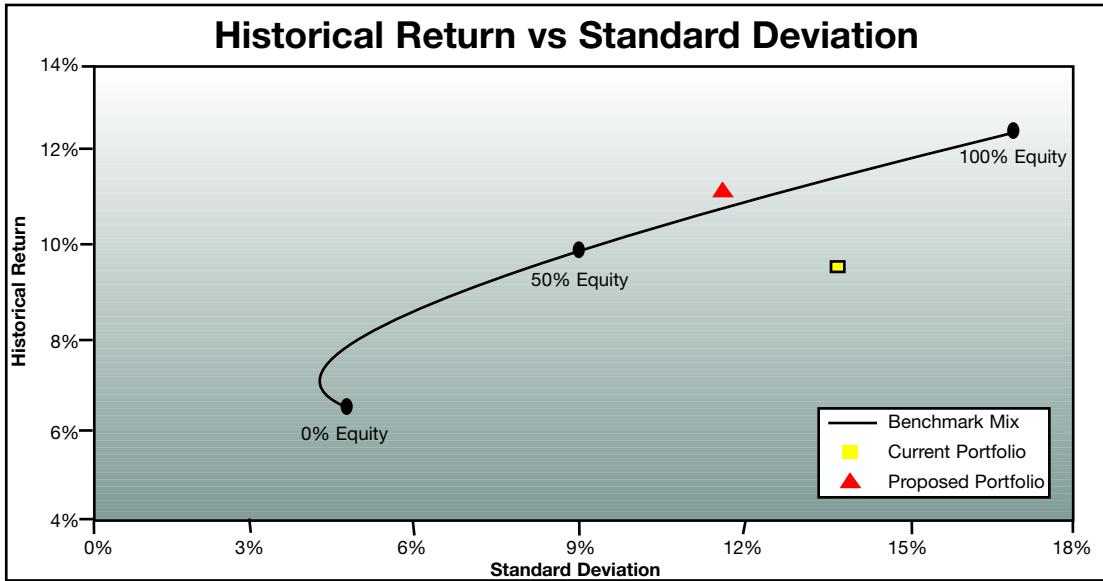


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