THE 6% RULE

DETERMINING A SUSTAINABLE PORTFOLIO WITHDRAWAL RATE
AND ADDRESSING THE FEAR OF RUNNING OUT OF MONEY IN RETIREMENT

Milliman

For retirees, investing in fixed income may not fulfill income or risk management needs, while investing heavily in equities may expose these investors to untimely amounts of risk. As Americans face this retirement income challenge, it is no wonder that running out of money in retirement is now of greater concern than public speaking.[1]

In this paper, we seek to answer one simple question: How can retirees provide for themselves when they no longer work? Our analysis indicates that the answer to this question lies in the proper calculation of a sustainable portfolio withdrawal rate, and the ability to manage three fundamental risk factors: market risk, inflation risk, and longevity risk. Successfully navigating these risk factors leads to a potentially increased portfolio withdrawal rate, with a high probability of success.

This paper has been divided into three sections, which work together in an effort to solve the retirement income challenge facing Americans. These sections are:

1. The development of a transparent, mathematical approach to calculating a sustainable withdrawal rate.

2. An introduction to the managed risk equities space.

3. Strategies to mitigate three major risk factors facing retirees—market risk, inflation risk, and longevity risk—thereby increasing the overall sustainable withdrawal rate.

Key findings:

- The mathematical approach to calculating a sustainable portfolio withdrawal rate outlined in this paper confirms the traditional 4% Rule used by many in the financial advisory community.

- The use of managed risk equities provides investors an opportunity to manage market risk and generate income without large allocations to fixed income instruments.

- Addressing inflation via a contingent method allows investors to address inflation as needed.

- Combining risk managed equities with the contingent growth method of inflation accounting leads to the 6% Rule, while maintaining a high probability of success.

- While not critical to development of the 6% Rule, longevity risk may be eliminated through the use of deferred income annuities, without damaging a portfolio's withdrawal rate.

- It is important to note there is no guarantee that an asset class, investment, or strategy will achieve its objectives, generate positive returns, or avoid losses.

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Reference Tables

TABLE 1

Sample Retiree Profile

Gender	Male
Age	65
Confidence Level	Moderate High
Total Annual Portfolio and Advisory Expenses	1.00%
Inflation Adjustment	2.5%, annual adj.

TABLE 2

Confidence Levels & Probability of Success

Confidence Level	Probability of Success
Moderate	87% - 92%
Moderate High	93% - 96%
High	96% - 99%

TABLE 3

Capital Markets Assumptions: Statistics for the Annual Effective Return over 1,000 Scenarios and 50 Projection Years

Asset Class	Index Representation	Mean (%)	St. Deviation (%)	Skew	Kurt
U.S. Large-Cap Equity	S&P 500 Index	10.52	18.44	-1.06	2.05
Managed Risk U.S. Large-Cap Equity	S&P 500 Index w/ MMRS Overlay	8.94	11.11	-0.09	-0.42
U.S. Small-/Mid-Cap Equity	Russell 2000 Index, S&P Midcap 400 Index	11.03	19.02	-0.86	1.59
Managed Risk U.S. Small-/Mid-Cap Equity	Russell 2000 Index w/ MMRS Overlay, S&P Midcap 400 Index w/ MMRS Overlay	9.34	12.01	0.03	-0.43
Developed International Equities	MSCI EAFE Index	8.84	17.70	-0.32	0.19
Managed Risk Developed International Equities	MSCI EAFE Index w/ MMRS Overlay	7.42	12.04	0.43	-0.02
Emerging Market Equities	MSCI Emerging Markets Index	12.45	19.59	-0.46	0.94
Managed Risk Emerging Market Equities	MSCI Emerging Markets Index w/ MMRS Overlay	10.42	12.78	0.22	-0.14
U.S. Bonds	Barclay's U.S. Aggregate Bond Index	4.06	6.95	1.48	4.93

Assumptions Based on Confidence Levels

Confidence Level	Market Risk (St. Dev.)	Conditional Tail Expectation	Est. Probability of Death at End of Planning Horizon
Moderate	1.0	40%	70%
Moderate High	1.5	50%	80%
High	2.0	60%	90%

Other Assumptions

Rebalance Frequency	Quarterly
Managed Risk Representation	Overlay of Milliman Managed Risk Strategy on each index
Withdrawal Frequency	Annual, at the end of each projection year
Tax Rate	None applied

Source: Milliman Financial Risk Management LLC, 2015.

The asset classes herein illustrate broad market segments. The performance data quoted is based on broad market indices. U.S. Large-Cap Equity is represented by the S&P 500 Index, a commonly used benchmark comprised of all the stocks in the S&P 500, weighted by market capitalization. U.S. Small/Mid-Cap Equity is represented by a 70%/30% allocation to S&P Midcap 400 Index, which is representative of the overall performance of U.S. mid-cap companies, and the Russell 2000 Index, which is representative of the overall performance of U.S. small-cap companies. Developed International Equities is represented by the The MSCI EAFE Index, which represents the performance of developed markets outside of North America: Europe, Australasia and the Far East. Emerging Market Equities is represented by the MSCI Emerging Markets Index, which designed to measure equity market performance in the global emerging markets. U.S. Bonds is represented by The Barclay's US Aggregate Bond Index, which tracks the performance of the USD-denominated, investment-grade, fixed-rate, taxable bond market. Overall annual portfolio advisory fees and expenses are assumed to be 1.00%. Actual fees and expenses may vary.

A stochastic analysis is a mathematical process used to model systems that behave randomly. The analysis in this paper illustrates the impact of each risk management approach on over 1,000 random market scenarios, calculated in accordance with standard actuarial process. The performance data quoted represents hypothetical past performance, is for illustrative purposes and is not intended to represent any actual investment(s). Capital markets assumptions are based on broad market indices, and are not representative of any actual investment. It is not possible to invest in an index. Results are for illustrative purposes only and do not represent actual performance of any investment. Current performance may be lower or higher than the performance data quoted above. Investment return and principal value will fluctuate, so that shares, when redeemed, may be worth more or less than their original cost. Past performance is no guarantee of future results.

THESE RESULTS HEREIN ARE BASED ON SIMULATED OR HYPOTHETICAL PERFORMANCE RESULTS THAT HAVE CERTAIN INHERENT LIMITATIONS. UNLIKE THE RESULTS SHOWN IN AN ACTUAL PERFORMANCE RECORD, THESE RESULTS DO NOT REPRESENT ACTUAL TRADING. ALSO, BECAUSE THESE TRADES HAVE NOT ACTUALLY BEEN EXECUTED, THESE RESULTS MAY HAVE UNDER-OR OVER-COMPENSATED FOR THE IMPACT, IF ANY, OF CERTAIN MARKET FACTORS, SUCH AS LACK OF LIQUIDITY. SIMULATED OR HYPOTHETICAL TRADING PROGRAMS IN GENERAL ARE ALSO SUBJECT TO THE FACT THAT THEY ARE DESIGNED WITH THE BENEFIT OF HINDSIGHT. NO REPRESENTATION IS BEING MADE THAT ANY ACCOUNT WILL OR IS LIKELY TO ACHIEVE PROFITS OR LOSSES SIMILAR TO THESE BEING SHOWN.

SECTION 1—CALCULATING A SUSTAINABLE WITHDRAWAL RATE

The Traditional Approach to Portfolio Withdrawals in Retirement

Traditionally, moving assets from equities to fixed income has served a dual role in an investor's portfolio: generate income and manage risk.

In the 1980s and 1990s, this approach was generally successful. Yields on fixed income assets were attractive relative to the risk levels that accompanied them. Today, however, relatively low yields, higher taxes, and market volatility have made it difficult for many retirees to generate income without taking on too much risk.

Along these lines, the traditional approach to calculating a sustainable portfolio withdrawal rate has relied heavily on allocations to fixed income assets. This approach was popularized in 1994 by William P. Bengen, CFP®, in his paper, "Determining Withdrawal Rates Using Historical Data." In the paper, Bengen analyzed over 75 years of market returns, and found that if a retiree had invested his or her retirement savings in 50% stocks and 50% bonds, and withdrew no more than 4% of his/her initial account value per year (adjusted for inflation), the retiree had a high probability that his/her money would last 30 years or longer. Conversely, a 5% portfolio withdrawal rate achieved the same result, but only 70% of the time.[2]

The Sustainable Withdrawal Rate Model

Setting an asset allocation along with a withdrawal rate assumption (e.g., 4%), and then backtesting the assumptions along various paths of a single return stream (i.e., historical market returns) has been one traditional method for determining a retiree's portfolio withdrawal rate. Other methods test similar assumptions over thousands of market scenarios (i.e., stochastic analysis) to determine a probability of success. Both approaches tend to operate from similar assumptions, and often generate similar results.

We find the withdrawal rate should not be an input, or assumption to be tested for validity; but rather the output, or calculated outcome. With this in mind, proper development of the withdrawal rate model is critical. It must meet rigorous standards, and plan for the threats that may significantly impact the sustainability of a portfolio, such as severe market corrections and continual portfolio withdrawals. The resulting withdrawal rate must also be accompanied by a high probability of success. The mathematical approach used to calculate a sustainable portfolio withdrawal rate takes these factors into consideration. Throughout this paper, we refer to this approach as the Sustainable Withdrawal Rate Model (SWM).

SWM works differently than conventional methods. Rather than setting a withdrawal rate and testing it for success, SWM is rooted in a retiree's confidence level. In other words, how certain would a retiree like to be that he/she will not run out of money in retirement? SWM uses this confidence level, along with other known information such as gender, age, and asset allocation, to calculate a sustainable withdrawal rate.

Once these inputs are established, SWM uses stochastic analysis to generate an average compounded annual growth rate (rather than test a withdrawal rate for success).[3] The average compound annual growth rate is then systematically reduced to account for the impact of adverse market conditions as well as the additional impact of withdrawals on a portfolio. These values are calculated using the return streams from the stochastic analysis and the initial retiree profile inputs. The resulting value is a return for planning purposes. The withdrawal rate is then calculated through a simple drawdown of the portfolio over the time horizon, using the annual return for planning purposes, and adjusted for inflation.

The ability to model long-term average returns of a portfolio, and account for short-term market variations (such adverse market events and the impact of portfolio withdrawals) gives financial advisors greater insight into how these factors interact with each other, and therefore, greater control and confidence over the output.

This process is illustrated at length via the following three steps.

Steps to Calculating a Sustainable Withdrawal Rate

To illustrate SWM, let's use the example of a 65-year-old male who has just entered retirement. He looks to his financial advisor to calculate a sustainable withdrawal rate from his retirement savings. Through conversations with his advisor, the retiree decides upon a moderate conservative risk tolerance, which may also translate to a moderate high level of confidence that his money will last throughout his lifetime. Profile inputs and other assumptions are outlined within the tables on the preceding page.

1 Merrill Edge Report, Spring 2014.
2 William P. Bengen, Determining Withdrawal Rates Using Historical Data Journal of Financial Planning, October 1994.
3 Milliman Financial Risk Management LLC, Stochastic modeling, 2014.

STEP 1

Identify Retiree's Confidence Level

The development of the retiree's sustainable withdrawal rate is anchored in his confidence level. In other words, how confident does the retiree want to be that his portfolio will last the length of his planning horizon?

This approach is well-aligned with the traditional financial planning model, in which a financial advisor works with each client to identify his/her specific risk tolerance level. A retiree's risk tolerance level may easily be translated into a confidence level for withdrawal purposes. For example, a retiree with a conservative risk tolerance would likely maintain a high confidence level for withdrawal purposes.

Table 2 defines the probability of success assigned to each confidence level. We define "success" as the ability to successfully take portfolio withdrawals throughout the planning horizon, without depleting the portfolio's value. Inflation will initially be accounted for as a static 2.5% annual adjustment. Later on, an alternative method for accounting for inflation will be explored.

STEP 2

Set Asset Allocation

Once the retiree's confidence level is set, the next step is to set his portfolio asset allocation. In Exhibit A, a pie chart illustrates a typical portfolio of a moderately conservative retiree; it is diversified among 65% equities and 35% fixed income. Capital markets assumptions for each asset class are outlined in Table 3.

STEP 3

Calculate Sustainable Withdrawal Rate

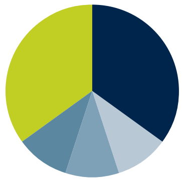
Once the portfolio asset allocation is established, the inputs are in place to calculate the sustainable withdrawal rate. The results are illustrated in Exhibit A.

EXHIBIT A

65/35 Asset Allocation Analysis

Stochastic Analysis: 65-year-old male, moderate high confidence, adjusted for inflation

Asset Class	Weight
U.S. Large-Cap Equity	35%
U.S. Small-/Mid-Cap Equity	10%
Developed International Equities	10%
Emerging Market Equities	10%
U.S. Bonds	35%



Results

Sustainable Withdrawal Rate	**4.1%**
Probability of Success	**94%**

Sustainable Withdrawal Rate Breakdown

Average Compounded Annual Growth Rate	7.8%
Impact of Adverse Market Environments	-3.4%
Sequence-of-Returns Effect	-1.4%
Return for Planning Purposes	3.0%
Planning Horizon	27 years

Source: Milliman Financial Risk Management LLC, 2015.

Results

In Exhibit A, the 65-year-old retiree is able to take a 4.1% sustainable withdrawal rate from his 65/35 portfolio, with a 94% probability of success. The SWM approach to calculating a sustainable portfolio withdrawal rate from a typical asset allocation portfolio arrived at a similar conclusion as that of conventional methods, albeit using a slightly lower allocation to fixed income assets.

For the sake of equal comparison to Bengen's original paper, the SWM calculation of a 50/50 portfolio allocation is 3.9%.

Components of the Sustainable Withdrawal Rate Model

SWM uses the following components to generate a withdrawal rate that matches the retiree's desired confidence level.

1. **Calculate the Average Compounded Annual Growth Rate**

   From the stochastic analysis, SWM derives the average compounded annual growth rate of the portfolio—the average year-over-year growth rate over a specified period of time. In Exhibit A (the 65/35 portfolio) this value is 7.8%. However, the retiree may not simply use this return for planning purposes, because adverse market environments will likely affect his ability to consistently withdrawal 7.8% each year. Additionally, portfolio withdrawals and the sequence in which portfolio returns occur can have a remarkable effect on a retiree's portfolio. As a result, these factors must be accounted for as well.

2. **Subtract to Account for the Impact of Adverse Market Environments**

   Providing sustainability in retirement means planning for an adverse-case scenario (i.e., the "black swan," or "tail risk" event). During these adverse market events, asset classes tend to become highly correlated and decline together. This can be devastating to a retirement savings portfolio. The sustainable withdrawal rate model accounts for the negative impact of adverse market environments by measuring the standard deviation of the cumulative returns over the planning horizon, annualizing it, and scaling it up by a factor associated with the confidence level (moderate, moderate high, or high). In Exhibit A, this means reducing the average compounded annual growth rate by 3.4%. The standard deviations used to calculate the impact of adverse market environments are listed in Table 4.

3. **Subtract to Account for the Sequence-of-Returns Effect**

   This metric accounts for the additional impact of portfolio withdrawals on wealth accumulation. For retirees, market downturns combine with portfolio withdrawals in a toxic way, especially if those declines come near the beginning of one's retirement years. In each exhibit we refer to this reduction as the Sequence-of-Returns Effect.

   For young investors, the "ride out the storm" method has been the tried-and-true approach. However, for a retiree who must use his/her portfolio to meet current income needs, it is not always possible to stop taking withdrawals and "ride out the storm." Continual withdrawals during down markets in effect kicks a retirement portfolio while it's down; mathematically, it puts it on a path that may lead to depletion.

   To account for the impact of withdrawals on wealth accumulation, and ultimately the sustainable withdrawal rate, the difference between the internal rate of return (IRR) over the planning horizon with and without withdrawals is calculated for each stochastic scenario. The average IRR over a subset of the worst scenarios is then used to generate the impact of withdrawals on overall wealth accumulation (i.e. the sequence-of-returns effect). This subset (conditional tail expectation) is selected based on the predetermined confidence level of the retiree. For the retiree with a moderate high confidence level, the average of the worst 50% of scenarios from the stochastic analysis is used. The conditional tail expectations used to calculate the sequence-of-returns effect are listed in Table 4.

   In Exhibit A, this means a further reduction of the average compounded annual growth rate of -1.4%.

4. **Equals a Return for Planning Purposes**

   The return for planning purposes is the average compounded annual growth rate, less the impact of adverse market environments, less the sequence-of-returns effect. In Exhibit A, the return for planning purposes is 3.0%.

5. **Determine Planning Horizon**

   Once the return for planning purposes is calculated, the planning horizon must be identified. The planning horizon is the time over which withdrawals must be taken. The greater the confidence level, the longer the planning horizon.

   For each confidence level, SWM calculates an estimated death probability specified at the end of the planning horizon. This approach attaches a confidence level, or probability, that the retiree will be deceased upon the completion of his planning horizon. Using the retiree's current age, and a mortality table (source: The Annuity 2000 Basic Table), SWM can derive the age at which the death probability matches that of the retiree's confidence level. The planning horizon is then calculated via the difference between the retiree's current age, and the age of probable death (which varies depending on the confidence level of the retiree). The estimated probabilities used are listed in Table 3.

   For this 65-year-old male with a moderate high confidence level, SWM figures there is an 80% chance he will have died by the end of his planning horizon (27 years, or age 92).

6. **Result: The Sustainable Withdrawal Rate**

   Once the planning horizon has been determined, SWM calculates the withdrawal rate through a simple drawdown over the planning horizon (27 years), assuming an annual return for planning purposes of 3.0%, and adjusted for inflation.

   To recap, the resulting sustainable withdrawal rate in Exhibit A (the 65/35 portfolio) is 4.1%, with a probability of 94%. The 4.1% withdrawal rate is taken in the first year of retirement. This figure (as a dollar amount) is then increased in subsequent years, assuming a 2.5% annual inflation rate.

SECTION 2 AN INTRODUCTION TO MANAGED RISK EQUITIES

The Managed Risk Equities Approach

As financial advisors face the challenge of helping retirees generate a reliable retirement income and manage risk, it is becoming clear that traditional planning techniques must improve. This includes identifying and using risk management tools that may not have been available to financial advisors when traditional planning methods were developed.

Financial Futures Contracts: Tools for Managing Risk

One example of the evolution of financial risk management was the development of financial futures contracts in the 1970s. Financial futures contracts, which are contractual agreements to buy or sell a financial instrument at a predetermined price in the future, established a way for large institutional investors to develop cost-effective safeguards in an effort to weather volatile markets.

Hedging with futures contracts has been in existence for many years. Farmers, for example, often sell agricultural futures on the crops they raise to hedge against a drop in prices, making it easier to plan for the long term. The same can be said for large financial institutions, which utilize futures contracts on major market indices in an effort to protect against volatility and broad based market declines. Universities often use futures contracts in an effort to protect the value of their endowments.

Managed Risk Equities

With much of the world's economy relying on futures contracts for price stability, risk management, and long-term planning, we believe it also makes sense to analyze the benefits of this type of risk management at the retail level, in an effort to provide financial advisors with tools that may help generate a sustainable retirement income for their clients.

The addition of this type of risk management overlay to the equity markets has created a new category within the investment industry, referred to as "managed risk equities."

To illustrate and analyze the effects of managed risk equities on a withdrawal rate, we apply the Milliman Managed Risk Strategy™ to the four broad equity market segments used in the Sustainable Withdrawal Rate Model.

Milliman Managed Risk Strategy

The Milliman Managed Risk Strategy seeks to stabilize the short-term volatility of a portfolio around a target level, (e.g., 12% standard deviation), capture growth in rising markets, and reduce the downside exposure of a fund during periods of significant and sustained market decline.

Prior to 2008, this type of sophisticated financial risk management was available only at the institutional level. Today, futures-based risk management strategies like the Milliman Managed Risk Strategy can be accessed at the retail level through various mutual funds, exchange-traded funds, collective investment trusts, target-date funds, and variable annuities, in an effort to weather market turbulence and improve clients' likelihood of meeting retirement goals.

Before analyzing the effects of the Milliman Managed Risk Strategy on a withdrawal rate (Exhibit C), it is important to gain an understanding of the methodology behind the strategy.

The Milliman Managed Risk Strategy is comprised of two risk management techniques:

1. **A volatility management process**, which seeks to stabilize portfolio volatility around a target level, and
2. **A capital protection strategy**, which seeks to provide ever-present long-dated portfolio put-like protection.

The Milliman Managed Risk Strategy is carried out via exchange-traded futures contracts (on major equity indices, U.S. Treasury bonds, and currencies). These instruments have been selected based on their high levels of liquidity, as well as the security provided by major exchanges as the counterparty in a hedging transaction. As such, the value can be readily accessed by investors, should their investment goals change. In particular, this approach readily accommodates changes in investor priorities with respect to capital growth and income (e.g., accumulating investors vs. decumulating investors).

Futures contracts are used only in an effort to reduce risk relative to a long-equity portfolio, and not in an effort to generate alpha.

Volatility Management Process

The volatility management process within the Milliman Managed Risk Strategy is designed to stabilize the volatility of a portfolio around a shorter-term (e.g., one month) standard deviation (e.g., 12%). This aims to keep the risk level of a portfolio from increasing significantly during periods of market turbulence. The volatility management process also seeks to earn additional returns based on the tendency of market volatility to decrease during extended periods of favorable market returns. This type of approach may exhibit a degree of underperformance during volatile rising markets. However, because increased volatility may be detrimental to a retiree's portfolio, sacrificing some upside for potentially stabilized volatility proves beneficial (see Exhibit C).

Most asset allocation models prescribe a static allocation to a set of funds in order to generate the most return for a given long-term volatility (e.g., 60% stocks, 40% bonds). The prescribed risk tolerance allocations are updated infrequently and are highly reliant on historical volatility norms as a forecast of future volatility. Because the past is not always prologue, the volatility management process involves a dynamic approach to forecasting short-term volatility, and synthetically adjusting portfolio weights (via exchange-traded futures contracts). This is done in an effort to ensure that a target level of volatility is maintained. This potentially avoids the volatility hot spots investors are accustomed to experiencing with statically allocated investments.

The methodology around the volatility management includes:

- a rebalancing process,
- computing the historical return stream of a high risk and low risk bucket, and
- a methodology for forecasting volatility and correlation.

Rebalancing Process

To achieve a target volatility, the underlying portfolio allocations are synthetically rebalanced between a group of assets with expected volatility that is typically above the target volatility—the "high risk bucket" (e.g., an equity portfolio), and cash (or another short-term fixed income investment.).

This synthetic rebalance is enacted via exchange-traded futures contracts. No actual movement of underlying portfolio assets is required. To the extent that the portfolio also holds fixed income investments (the low risk bucket), volatility and correlation of these investments will be measured and incorporated into the calculation. To determine the recommended weight to the high risk bucket, the volatility management process of the Milliman Managed Risk Strategy produces a forecast of the covariance of the buckets.

When a rebalancing trade is executed, the futures amounts traded are taken from the mapped exposures within the high risk bucket.

Because a volatility forecast may be noisy, and transaction costs are incurred when a rebalancing trade is executed, a trading threshold based on the change in recommended allocation is used. This helps reduce trading costs, as well as improve the volatility targeting process.

Computing the Historical Return Stream of the High Risk and Low Risk Buckets

The historical high and low risk bucket returns are the primary state information used in the calibration of the volatility and correlation models. Careful consideration must be taken to construct the historical returns.

For each investment (e.g., mutual fund, ETF, single stock, fixed income security) within a particular bucket, the relative weight of each investment is calculated, taking into account the absolute weight of the investment in the portfolio, the relative weight of the investment in the bucket, and the historical returns of each investment (continuously compounded). The time step for constructing these returns is daily. Then, a single return stream is compiled for each bucket, which captures the implicit volatility and correlation of the investment within each bucket.

Volatility and Correlation Forecasting

A key to the success of any volatility targeting methodology is the accuracy of the forecast. While there is inherent inexactness to any forecasting mechanism, the Milliman Managed Risk Strategy aims to reduce this error via separate, customized forecasting models for the high risk bucket, low risk bucket, and correlation.

High Risk Bucket Forecast: The model used for the high risk bucket describes the volatility of returns in terms of a transient component and a persistent component. The volatility management process uses both of these components to respond to rapidly changing market conditions, while adapting to variations in the long-term outlook (via trades in futures contracts).

Low Risk Bucket Forecast: The low risk bucket is typically comprised of fixed income securities, and as such, does not exhibit the same stylistic characteristics of volatility as the high risk bucket. Because of this, a single factor model sufficiently provides a dynamic forecast for fixed-income volatility.

Correlation Forecast: A correlation forecast between the high risk bucket and the low risk bucket may be used in the volatility targeting of the overall portfolio. In cases where the correlation forecast is shown to improve the volatility targeting and the correlation forecast changes significantly, Milliman FRM's volatility management process will allocate more to the low volatility bucket when the buckets show positive correlation, and vice versa when the forecast is negative.

Capital Protection Strategy

One of Milliman FRM's core disciplines is the proven operational capability to use futures contracts to manufacture an evergreen long-dated put option on a portfolio. This process is referred to as the "capital protection strategy."

The capital protection strategy adjusts futures positions daily (subject to market-based thresholds) in an effort to preserve the capital of a portfolio on a rolling five-year basis. In a severely declining market, futures gains may be harvested and reinvested in growth assets in an effort to maximize long-term returns.

Manufacturing a Put Option with Futures Contracts

Over the past 30 years, various trading vehicles have been used to hedge portfolio risk, namely, options and futures contracts. For example, today, one may go into the market and purchase a put option directly, which, for a price (the premium), will provide downside protection should the underlying portfolio decline beyond a certain threshold (the strike).

This put "protection" is composed of the following parameters: valuation interest rate, the maturity, the strike, and a volatility input. All of these components are critical to the standard Black-Scholes option pricing model. Knowing these parameters, it is often advantageous to synthetically replicate the payout features of a put option using other instruments, such as financial futures contracts. Manufacturing a put option in this manner offers the creator of the option the ability to customize the parameters of the option in order to meet the needs of the underlying portfolio, and in a potentially more efficient manner. For example, it would not be feasible for a financial advisor or investor to purchase a five-year evergreen put option with a dynamically moving strike. They simply do not exist in the open market.

By manufacturing a put option using futures contracts, Milliman FRM is able to set the maturity and strike at levels the Milliman Managed Risk Strategy deems appropriate. Additionally, the Milliman Managed Risk Strategy is able to set these levels on a daily basis. The strategy carries out this process by managing a portfolio that seeks to exhibit a target level of equity market sensitivity per dollar invested (delta), and a target level of interest rate sensitivity per dollar invested (rho), depending on the interest rate environment. These sensitivities are derived from standard actuarial models and option pricing techniques. The portfolio also seeks to hold an amount of cash similar to the value of the put option. This cash position naturally supports the margin requirements of the hedge instrument.

This approach provides greater flexibility in managing overall risk within the portfolio, and controlling the potentially negative impact of volatility premiums, time decay, and static strikes.

Setting Strategy Parameters

As stated previously, the key parameters that define the value of the manufactured put option at any point in time along a particular path are:

- the valuation interest rate,
- the maturity,
- the strike, and
- basket volatility.

The next section will explain each parameter in greater detail.

Interest Rate

The interest rate is fundamental in determining the discounting rate of the manufactured put option, as well as the discounted strike. Generally, this is the market zero coupon rate of the same maturity as the manufactured put option.

Maturity

The maturity of the manufactured put option determines the intensity of the protection level. For example, a hedge is more active on a manufactured put option with a shorter maturity, and vice versa for a longer maturity. Typically, hedges with shorter maturities require more frequent delta rebalancing trades; thus, they incur a greater degree of trading cost. For this reason, the Milliman Managed Risk Strategy synthetically manufactures an evergreen, longer-dated (five-year), put option. Generally, the maturity is reset daily, subject to market-based thresholds.

Additionally, while the Milliman Managed Risk Strategy is intended to cushion downside risk and reduce volatility, it does so without a guaranteed floor on losses. This type of strategy does not require a large amount of intra-day trading, and it avoids the pitfalls commonly associated with hedging strategies that implement a floor. Namely, this avoids a selling spiral that has the potential to push a sudden bear market down even further (e.g., portfolio insurance during the crash of 1987).

Strike

The strike is the most direct indication of the intensity of the capital protection strategy. If the strike is unchanged throughout the life of the portfolio, investors who purchase and sell the same risk managed portfolio at different points in time will have markedly different experiences. To keep the strike current, a dynamic strike update rule is applied.

The goal of the Milliman Managed Risk Strategy in relation to the strike is to provide asymmetry in the return distribution. In other words, the right tail is reduced by less than the left tail.

Volatility

Within an option pricing model (e.g., Black-Scholes), volatility is an unknown value, and is assumed to be constant. Because of this uncertainty, purchasing a put option directly incurs a price premium in order to account for fluctuations in volatility. As market volatility increases, the cost of the hedge inherently becomes more expensive. This is counter intuitive to any risk management strategy, as the cost of hedging becomes relative to the volatility in the market.

With the Milliman Managed Risk Strategy, the volatility "input" of the put option model is set based on the parameters from the volatility management of the portfolio. By managing the portfolio's volatility around a target level, the once unknown volatility input becomes a relatively stable value. This not only creates a more efficient hedge, but it also creates the potential to smooth out the overall investment experience.

Net Equity Exposure

The final recommendations of the Milliman Managed Risk Strategy involves futures trades from both the volatility management process and capital protection strategy.

The Milliman Managed Risk Strategy then provides a net trade recommendation to be executed. This is accomplished by calculating the sum of the futures recommendations for each component. This execution provides an overall futures position on the underlying portfolio. In application, this futures position creates a net equity exposure level of the underlying portfolio. The net equity exposure within a portfolio changes continuously (daily) in an effort to help stabilize volatility, capture growth in up markets, and reduce the impact of sustained market declines. As equity markets become more volatile, a managed risk portfolio's net effective equity exposure generally decreases, and vice versa. Net equity exposure reflects all aspects of a portfolio's overall investment strategy, including the Milliman Managed Risk Strategy. This includes all portfolio holdings, cash, and futures.

Now that we have established a framework for managed risk equities, let's analyze their effects within a retiree's portfolio.

SECTION 3
ADDRESSING RISK FACTORS TO INCREASE THE WITHDRAWAL RATE

The proper development of a withdrawal rate model is critical. However, the model itself does not reduce the threats facing retirees' financial sustainability. It simply accounts for them. In order to improve upon the withdrawal rate in a reliable way, financial advisors must use methods to address the risks that dampen the overall withdrawal rate. In this section, we will focus on three main risks facing retirees—market risk, inflation risk, and longevity risk, and illustrate strategies that seek to mitigate each risk, ultimately leading to the 6% Rule.

Addressing Market Risk

The ability to address market risk is critical to a sustainable retirement income. When combined with portfolio withdrawals, increased portfolio volatility and large down markets can be devastating to retirement savings. The challenge in traditional planning methods lies in the trade-off of risks between allocating to equities and fixed income assets. Too much equities may mean too much market risk. While too much fixed income may equate to a lack of growth. In some ways, it is a zero sum game. This can be quantified by examining the effects of allocating into 100% equities, and 100% fixed income, respectively (see Exhibit B).

EXHIBIT B

100% Equity & 100% Fixed Income Analysis

Stochastic Analysis: 65-year-old male, moderate high confidence, inflation adjusted

Asset Class	100% Equity	100% Fixed Income
U.S. Large-Cap Equity	50%	0%
U.S. Small-/Mid-Cap Equity	20%	0%
Developed International Equities	20%	0%
Emerging Market Equities	10%	0%
U.S. Bonds	0%	100%

Results

	100% Equity	100% Fixed Income
Sustainable Withdrawal Rate	**3.6%**	**3.2%**
Probability of Success	**93%**	**94%**

Sustainable Withdrawal Rate Breakdown		
Average Compounded Annual Growth Rate	9.2%	3.9%
Impact of Adverse Market Environments	-5.0%	-2.0%
Sequence-of-Returns Effect	-2.1%	-0.6%
Return for Planning Purposes	2.0%	1.2%
Planning Horizon	27 years	27 years

Source: Milliman Financial Risk Management LLC, 2015.

Potential Risks of a 100% Equity Portfolio

The effect of allocating to 100% equities is a sustainable withdrawal rate of 3.6%—50 basis points lower than the sustainable withdrawal rate of the 65/35 portfolio in Exhibit A. This is largely due to the need to account for an increase in adverse market environments, and sequence-of-returns risk associated with equity markets. Not surprisingly, this indicates that the risk inherent to an all equity allocation is market related, and accounting for this increased market risk substantially reduces the return for planning purposes, thus reducing the overall withdrawal rate.

Potential Risks of a 100% Fixed Income Portfolio

The sustainable withdrawal rate of the 100% fixed income portfolio is 3.2%—90 basis points lower than the sustainable withdrawal rate in Exhibit A. While the reduction for the impact of adverse market environments and sequence-of-returns effect is much less than the all-equity portfolio, the growth potential is significantly dampened. It is evident that the risk associated with an all-fixed income portfolio is not related to adverse markets, or the sequence-of-returns effect, as much as it is to the current yield of the underlying fixed income securities, and inflation. As a result, in an environment with insufficient yield, or when excess risk must be taken to achieve sufficient yield, investing in fixed income offers some protection against market risk, but greatly reduces the retiree's withdrawal rate.

Perhaps one of the most significant and foretelling statements in Bengen's 1994 paper is the advice he gives financial advisors regarding the client who has just emerged from a hypothetical market crisis. He states, "The one alternative [your client] cannot afford, and which we as advisors must work hard to dissuade him from doing, is to pull back from the stock market and retreat to bonds." Today, this may be truer than ever.

Managing Market Risk by Allocating to Managed Risk Equities

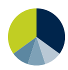
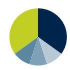
Exhibit C examines the sustainable withdrawal rate of the retiree's traditional 65/35 portfolio, as well as a managed risk 65/35 portfolio, which replaces the traditional 65% equity allocation with the same equity allocation, plus the addition of the Milliman Managed Risk Strategy.

EXHIBIT C

65/35 Portfolio Analysis

Stochastic Analysis: 65-year-old male, moderate high confidence, inflation adjusted

Asset Class	Traditional 65/35	Managed Risk 65/35
U.S. Large-Cap Equity	35%	35%
U.S. Small/Mid-Cap Equity	10%	10%
Developed Int'l Equities	10%	10%
Emerging Market Equities	10%	10%
U.S. Bonds	35%	35%

Results

	Traditional 65/35	Managed Risk 65/35
Sustainable Withdrawal Rate	**4.1%**	**4.5%**
Probability of Success	**94%**	**93%**

Sustainable Withdrawal Rate Breakdown		
Average Compounded Annual Growth Rate	7.8%	7.1%
Impact of Adverse Market Environments	-3.4%	-2.3%
Sequence-of-Returns Effect	-1.4%	-1.1%
Return for Planning Purposes	3.0%	3.7%
Planning Horizon	27 years	27 years

Source: Milliman Financial Risk Management LLC, 2015.

THESE RESULTS HEREIN ARE BASED ON SIMULATED OR HYPOTHETICAL PERFORMANCE RESULTS THAT HAVE CERTAIN INHERENT LIMITATIONS. UNLIKE THE RESULTS SHOWN IN AN ACTUAL PERFORMANCE RECORD, THESE RESULTS DO NOT REPRESENT ACTUAL TRADING. ALSO, BECAUSE THESE TRADES HAVE NOT ACTUALLY BEEN EXECUTED, THESE RESULTS MAY HAVE UNDER-OR OVER-COMPENSATED FOR THE IMPACT, IF ANY, OF CERTAIN MARKET FACTORS, SUCH AS LACK OF LIQUIDITY. SIMULATED OR HYPOTHETICAL TRADING PROGRAMS IN GENERAL ARE ALSO SUBJECT TO THE FACT THAT THEY ARE DESIGNED WITH THE BENEFIT OF HINDSIGHT. NO REPRESENTATION IS BEING MADE THAT ANY ACCOUNT WILL OR IS LIKELY TO ACHIEVE PROFITS OR LOSSES SIMILAR TO THESE BEING SHOWN."

As illustrated, the sustainable withdrawal rate of the managed risk portfolio is improved by 40 basis points, to 4.5%. While the average compounded annual growth rate is less than that of the traditional portfolio, allocating to managed risk equities has provided for a material reduction in the impact of adverse market environments as well as reduced the negative impact of withdrawals on the portfolio.

Addressing the impact of adverse markets and sequence-of-returns effect via managed risk equities ultimately reduces market risk. As a result, the retiree may potentially reduce his overall exposure to fixed income assets, and participate in the growth potential of stocks to a greater degree. In fact, if the retiree were to increase the equity exposure of the managed risk portfolio from 65% to 100%, the impact of adverse market environments would still be less than that of the traditional 65/35 portfolio (-3.1% vs. -3.4%). This is illustrated in Exhibit D.

EXHIBIT D

Impact of Increasing Risk Managed Equity Exposure

Stochastic Analysis: 65-year-old male, moderate high confidence, inflation adjusted

Asset Class	Traditional 65/35	Managed Risk 100% Equities
Managed Risk U.S. Large-Cap Equity	35%	50%
Managed Risk U.S. Small/Mid-Cap Equity	10%	20%
Managed Risk Developed Int'l Equities	10%	20%
Managed Risk Emerging Market Equities	10%	10%
U.S. Bonds	35%	0%

Results

	Traditional 65/35	Managed Risk 100% Equities
Sustainable Withdrawal Rate	**4.1%**	**4.5%**
Probability of Success	**94%**	**94%**

Sustainable Withdrawal Rate Breakdown		
Average Compounded Annual Growth Rate	7.8%	8.5%
Impact of Adverse Market Environments	-3.4%	-3.1%
Sequence-of-Returns Effect	-1.4%	-1.5%
Return for Planning Purposes	3.0%	3.8%
Planning Horizon	27 years	27 years

Source: Milliman Financial Risk Management LLC, 2015.

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While this illustrates the ability to reduce, or eliminate fixed income exposure from the portfolio, with potentially less market risk than the traditional 65/35 portfolio, it does not necessarily warrant a move to 100% managed risk equities. The sustainable withdrawal rate of the managed risk 65/35 portfolio in Exhibit C, and the sustainable withdrawal rate of the managed risk 100% equity portfolio in Exhibit D are both 4.5%.

However, our research indicates there is a far greater reason warranting a larger allocation to managed risk equities: to reduce the effects of inflation.

Recalculating Inflation

Over time, prices for goods and services tend to rise. Subsequently, purchasing power tends to fall. This is the premise of inflation.

Bonds do not provide protection against inflation. In fact, the opposite is true—inflation generally erodes the real purchasing power of bonds. For this reason, retirees may be susceptible to inflation risk because their portfolios often include large allocations to bonds. Equities, on the other hand, do not share such a relationship with inflation. In fact, over time equities generally share a positive correlation to inflation.

For these reasons we believe there are two plausible ways a retiree may account for inflation:

1. Pre-funding Inflation Accounting Strategy (traditional)
2. Contingent Growth Inflation Accounting Strategy (alternative)

Pre-Funding Inflation Accounting Strategy

The traditional approach to accounting for inflation has been to set an arbitrary inflation assumption, such as 2.5%, and adjust the withdrawal amount by this static inflation value each year. This accounting approach forces retirees to consume less today, and set aside more money in order to "pre-fund" the damaging effects of inflation in the future. This is typically accomplished by way of a lower withdrawal rate. One potential setback of this approach is that a static annual increase does not take into account adverse market environments—when interest rates are likely to be near, or at, 0%—or booming markets—when inflation may be higher than 2.5%. In fact, since 1928, annual inflation has been between two and three percent 19% of the time. This equates to 69 out of 85 years where real inflation does not align with a static 2.5% adjustment.[4]

Contingent Growth Inflation Accounting Strategy

A contingent growth strategy may be a more common-sense approach. Because equities share a generally positive correlation to inflation over time, moving into managed risk equities may provide a more natural inflation hedge. In application, inflationary price increases will generally be reflected by an increasing stock market

[4] Bureau of Labor Statistics, CPI Detailed Report, 2014.

over time. With this in mind, the retiree may use any additional gains in excess of the return for planning purposes to adjust for inflation. In periods where inflation is nonexistent (e.g., sustained adverse markets), there is no need for an inflation adjustment.

By relying on managed risk equities to manage market risk and generate income, the retiree may gain a degree of insulation against adverse changes in interest rates, as well as the opportunity to generate a higher and more sustainable retirement income than the traditional pre-funding approach.

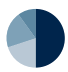
The effects of implementing a contingent growth inflation accounting strategy are illustrated in Exhibit E.

EXHIBIT E

Impact of Inflation Accounting via Contingent Growth Strategy

Stochastic Analysis: 65-year-old male, moderate high confidence, contingent growth inflation adjustment

Asset Class	100% Managed Risk Equities, Cont. Growth Inflation Adj.
Managed Risk U.S. Large-Cap Equity	55%
Managed Risk U.S. Small/Mid-Cap Equity	15%
Managed Risk Developed Int'l Equities	15%
Managed Risk Emerging Market Equities	15%
U.S. Bonds	0%



Results

	100% Managed Risk Equities, Cont. Growth Inflation Adj.
Sustainable Withdrawal Rate	**6.0%**
Probability of Success	**94%**

Sustainable Withdrawal Rate Breakdown	
Average Compounded Annual Growth Rate	8.6%
Impact of Adverse Market Environments	-3.1%
Sequence-of-Returns Effect	-1.7%
Return for Planning Purposes	3.8%
Planning Horizon	27 years

Source: Milliman Financial Risk Management LLC, 2015.

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Result: The 6% Rule

The outcome of addressing market risk and inflation risk via managed risk equities is a 6.0% sustainable withdrawal rate, with a 94% probability of success, over a 27-year planning horizon.

Note the return for planning purposes in this analysis is 3.8%. A 3.8% annual equity market return would likely coincide with a severely depressed economic environment. This would also likely be accompanied by minimal inflation, or possibly deflation. Because the sustainable withdrawal rate model plans to an adverse market environment, to the extent that the retiree's return exceeds 3.8%, any excess portfolio value may be used to provide a cost-of-living increase.

To summarize, the road to the 6% Rule is as follows:

1. Begin with a proper framework for calculating a sustainable withdrawal rate (SWM Approach).
2. Account for the impact of adverse market environments and sequence-of-returns effect to obtain an accurate return for planning purposes.
3. Address growth potential and market risk via managed risk equities.
4. Account for inflation as needed.

Addressing Longevity Risk

While not critical to the development of a 6% withdrawal rate, it is possible to address a third risk to a retiree's financial sustainability. This is longevity risk—the risk that the retiree will outlive his planning horizon (in this example, beyond age 92).

Centenarians are quickly becoming one of the fastest growing age groups. Today, there are about 70,000 Americans who have reached the age of 100. According to the U.S. Census Bureau, this number is expected to grow to 600,000 by 2050.[5]

Deferred Income Annuities

Our approach to managing longevity risk is through the use of a deferred income annuity (DIA). A DIA is an insurance product that provides lifetime income payments, beginning (or deferred) 13 months to 50 years from the purchase date. Income payments may be designated for the lifetime of the annuitant, and the policy has no traditional cash value. For example, the retiree may purchase a DIA at age 65, in order to replace his 6% income stream at a given point in the future, say age 80. This approach seeks to eliminate the retiree's longevity risk, because beginning at age 80, the income payments from the DIA will replace the income payments from the retiree's portfolio.

[5] U.S. Census Bureau, May 2011.

Exhibit F illustrates the effects of purchasing a DIA using a percentage of the retiree's initial portfolio value, in order to replace a 6% withdrawal rate, with payments beginning at age 80.

Using the most current deferred income annuity tables, we can calculate the cost of purchasing this longevity protection, which in this case equals 21% of the retiree's initial portfolio value.

EXHIBIT F

Impact of Adding a Deferred Income Annuity

Stochastic Analysis: 65-year-old male, moderate high confidence, contingent growth inflation adjustment, w/ DIA at age 80

Asset Class	100% Managed Risk Equities	100% Managed Risk Equities w/ DIA
Managed Risk U.S. Large-Cap Equity	55%	55%
Managed Risk U.S. Small-/Mid-Cap Equity	15%	15%
Managed Risk Developed Int'l Equities	15%	15%
Managed Risk Emerg. Market Equities	15%	15%
U.S. Bonds	0%	0%

Results

	100% Managed Risk Equities	100% Managed Risk Equities w/ DIA
Sustainable Withdrawal Rate	**6.0%**	**6.1%**
Probability of Success	**94%**	**94%**
Sustainable Withdrawal Rate Breakdown		
Avg. Compounded Annual Growth Rate	8.6%	8.6%
Impact of Adverse Mkt. Environments	-3.1%	-3.1%
Sequence-of-Returns Effect	-1.7%	-1.7%
Return for Planning Purposes	3.8%	3.8%
Planning Horizon	27 years	Lifetime
% of Today's Portfolio Value for DIA Purchase[6]	0%	21%

Source: Milliman Financial Risk Management LLC, 2015.

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As illustrated, even with the large initial cash outlay to purchase the DIA, the sustainable withdrawal rates are nearly identical for both portfolios. This is because the planning horizon is reduced for the retiree holding the DIA. He only needs to rely on portfolio withdrawals for 15 years (age 65 to 80), as opposed to 27 years (age 65 to 92). This reduction in planning horizon and addition of the DIA allows the retiree to take a 6.1% withdrawal, while gaining DIA income payments for life, beginning at age 80, thus eliminating longevity risk.

Conclusion

For decades, conventional wisdom has said, "When the market goes down, ride out the storm. Eventually, the damage to your portfolio will be repaired." In short, "Wait it out; and batten down the hatches."

For those nearing or in retirement, "wait it out" may not be the best answer. This group of investors is facing low yields and a domestic stock market at all-time highs, making it difficult to meet both income and risk management needs. Investing heavily in equities may expose this group of investors to untimely amounts of risk, while allocating to fixed income assets may not adequately fulfill income needs.

Today, financial advisors and investors can seek to address these concerns through managed risk equities.

Sustainable Withdrawal Rate Calculator

Milliman Financial Risk Management LLC has developed a calculator powered by the same mathematical approach outlined in this paper. This is the first sustainable withdrawal rate calculator of its kind. You can find it at www.protectedincomeplanner.com.

About Milliman Financial Risk Management LLC

Milliman Financial Risk Management LLC (Milliman FRM)—a global leader in financial risk management—provides investment advisory, hedging, and consulting services on $150 billion of global assets (as of December 31, 2014). Milliman FRM is a subsidiary of Milliman, Inc.—one of the world's largest independent actuarial and consulting firms.

[6] Percentage of today's portfolio value for deferred income annuity purchase is based on the most recent tables provided by a major life insurer.

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