ProFolio

Take Control Of Your Financial Future

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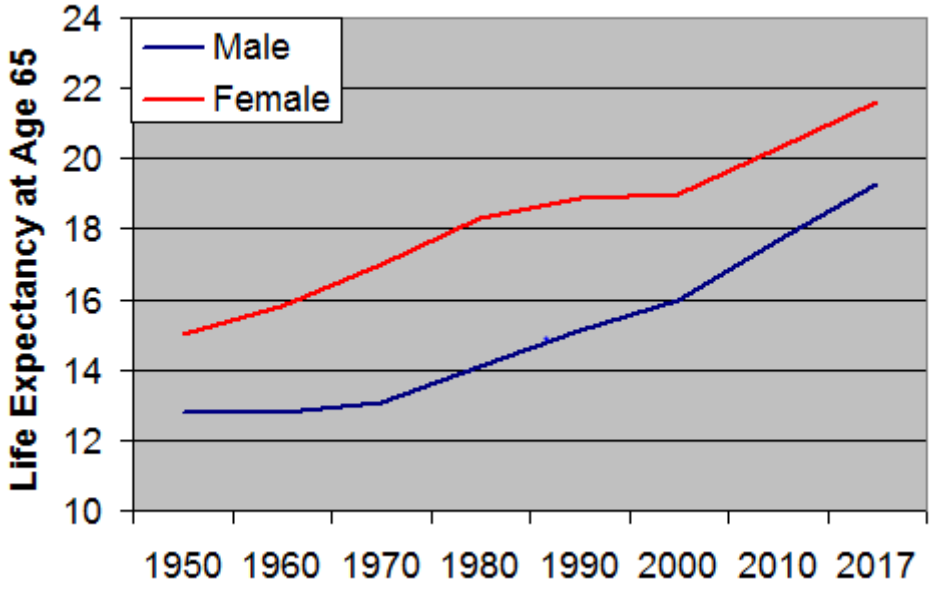
Introduction

Take Control Of Your Financial Future

The model life is divided into three phases: 1) being supported prior to being independent, 2) supporting yourself during your earning years and creating a surplus 3) living off of the surplus in retirement. It is essential to have enough of a surplus to support your retirement. According to the Social Security Administration, at the full retirement age of 65, men have a life expectancy over 19.3 years and women have a life expectancy over 21.6 years. Half the people will live even longer than the average. Currently about 25% of people aged 65 have a life expectancy of 25 years and 10% have a life expectancy of 30 years. Additionally, these life expectancy numbers are only increasing. It is great to have a long life, but it is especially important during our earning years to create enough of a surplus to support a long retirement. No one wants to live their final years in poverty. In order to ensure you can support yourself, you need to take control of your financial future.



Take control by having confidence the investments you have will provide the income you need during retirement. Expected portfolio return is important, but having an expected return that meets your target still only leaves you with a 50% probability of meeting that target when factoring in portfolio volatility or risk. Understanding your investment's expected return and volatility gives you the confidence you need by defining both the probability of loss and probability of meeting your goals.

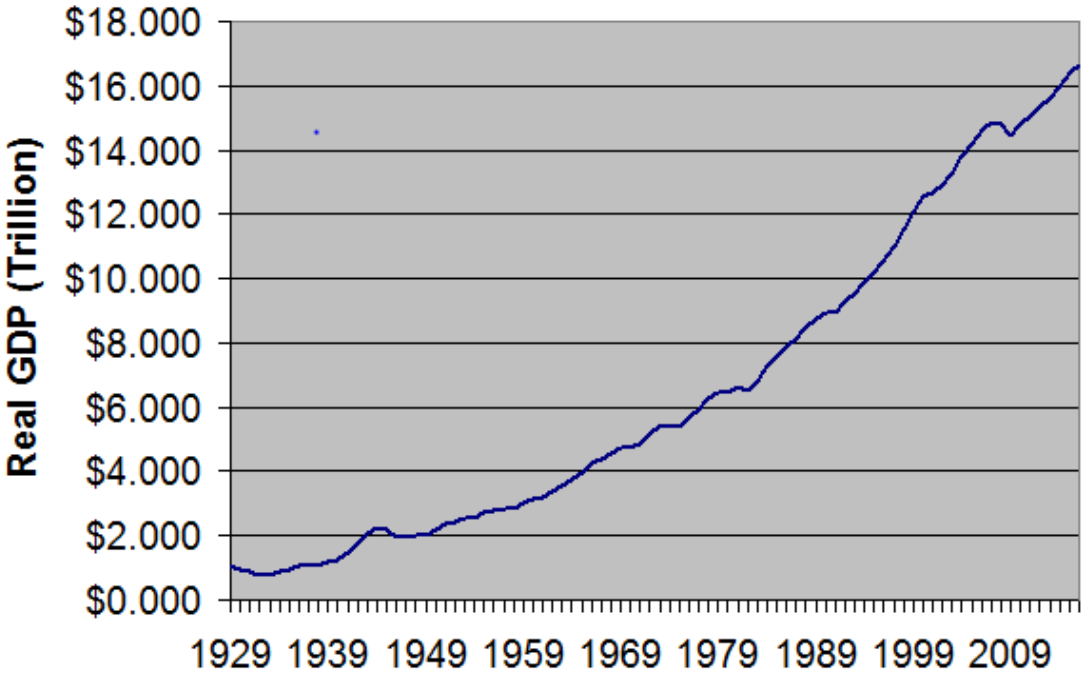
Depending upon your attitudes toward risk and where you are on your path towards meeting your goals, you can choose an investment return and risk profile that's right for you.

1) https://www.ssa.gov/planners/lifeexpectancy.html
2) https://www.cdc.gov/nchs/data/hus/2011/022.pdf

Part 1: Economic Background

GDP - A Story Of Wealth Creation

Investors look to share in economic growth. In order to understand where the economy may be going, it is useful to understand where it has been. A simple chart of real GDP shows vast growth in Gross Domestic Product - which is a measure of the total dollar value of all the goods and services produced in the United States in a given year. GDP is a growth function in that the current growth is on top of all the growth that occurred in the past. Growth in some goods and services may decline while others expand, but in aggregate the usual state is for growth in GDP. Real GDP takes out the effects of inflation and averaged 3.22% from 1929 through 2016.



Investing assists in the growth function of GDP by giving capital to businesses to grow. In return, the investors share in a slice of that growth.

3) https://www.thebalance.com/us-gdp-by-year-3305543

The Father Of Modern Economics

For an even broader understanding of economic trends, we can can go back even further. Adam Smith is widely considered to be the father of modern economics. He wrote his signature work, "An Inquiry into the Nature and Causes of the Wealth of Nations" or simply "Wealth of Nations" in 1776 where he described how rational self interest and competition can lead to prosperity. He describes how an individual working to produce what is of the greatest value and intending only his own gain is guided by an invisible hand to produce what is best for society even if that was not his original intention. The invisible hand of the market, or law of supply and demand, insures that the right number of people produce the right number of goods. When demand rises, prices rise and more people find it profitable to produce those goods until supply meets demand.

Adam Smith also talked about the law of accumulation which refers to the accumulation of profits. Profits accumulate which are put back into production, increasing worker demand and leading to higher wages. This leads to a higher standard of living for owners and workers.

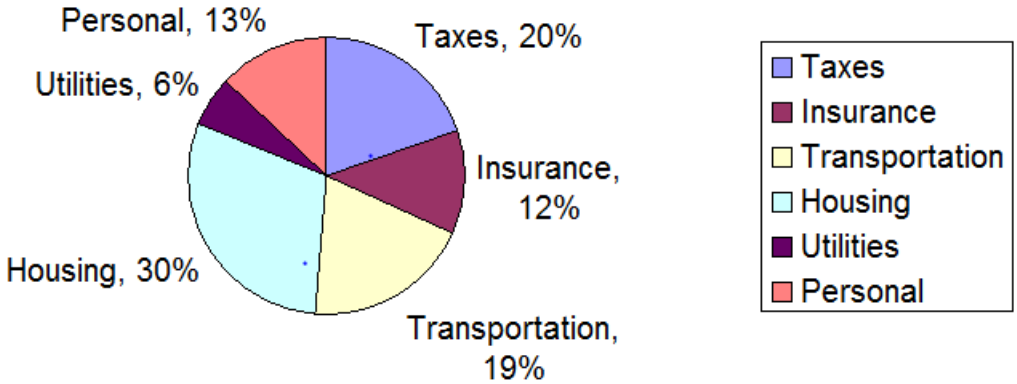
He saw society go from a nation of hunters, to shepherds, to farmers and then to a commercial society and believed there was an underlying engine causing society to continuously improve. In the 250 years since he published his work, we have seen society improve through the industrial revolution, electricity, automobiles, airplanes, computers and the information age all the while standards of living have been increasing in aggregate.

4) http://www.econlib.org/library/Smith/smWN.html
5) http://www.iep.utm.edu/smith/

Part 2: The Economy And You

Where A Typical Paycheck Goes

Here is a breakdown on where the typical paycheck goes: taxes 20%, insurance 12%, transportation 19%, housing 30%, utilities 6% and personal 13%. Personal includes food, clothing and other expenses.

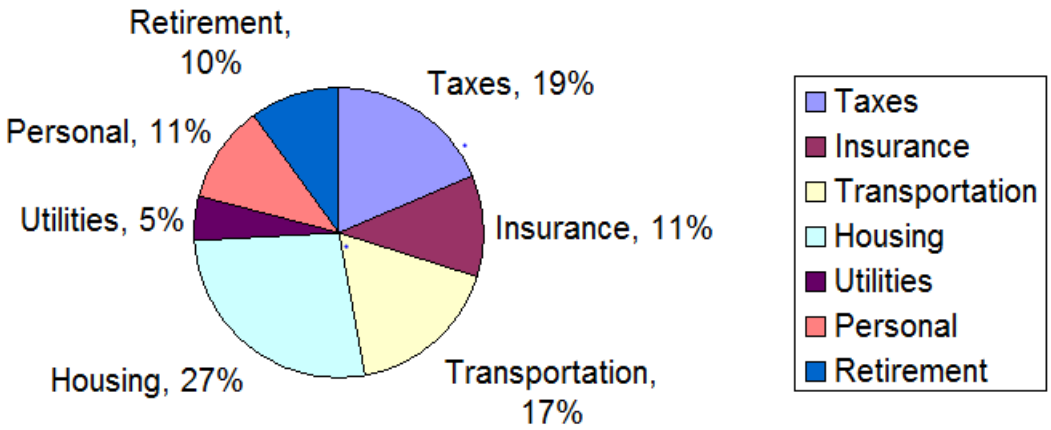


8) https://www.nerdwallet.com/blog/insurance/where-people-pay-most-least-for-homeowners-health-auto-life-insurance-2015/
9) https://www.fhwa.dot.gov/livability/fact_sheets/transandhousing.cfm
10) http://genxfinance.com/poll-how-much-do-you-spend-on-utilities-each-month/
11) http://www.fedsmith.com/2015/07/23/how-much-does-the-average-american-worker-pay-in-taxes/

Your Working Years Pay For Your Retirement Years

You will need about 70% of your pre-retirement income in retirement to maintain your standard of living, yet, for average earners, Social Security benefits provide approximately 40% of that. The majority of retirement income will have to come from somewhere other than Social Security. From 1990 to 2012 the number of private industry workers getting pensions fell from 42% to 22%. The trend is unmistakable- workers have to support the bulk of their own retirement.

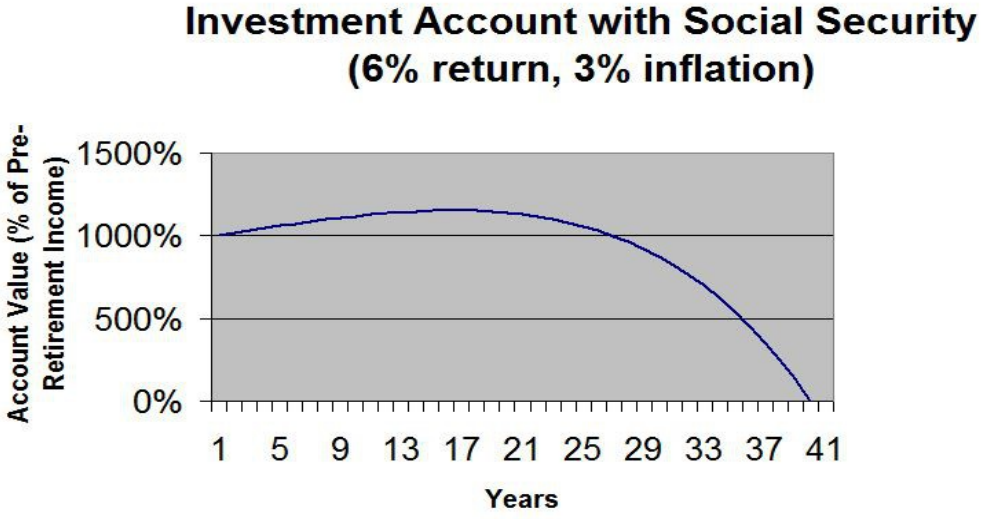
In order to support retirement, it is important to set aside 10% of your income right off the top and budget the rest accordingly. A revised budget with retirement savings set aside breaks down as: Taxes 19%, Insurance 11%, Transportation 17%, Housing 27%, Utilities 4%, Personal 12% and Retirement 10%.



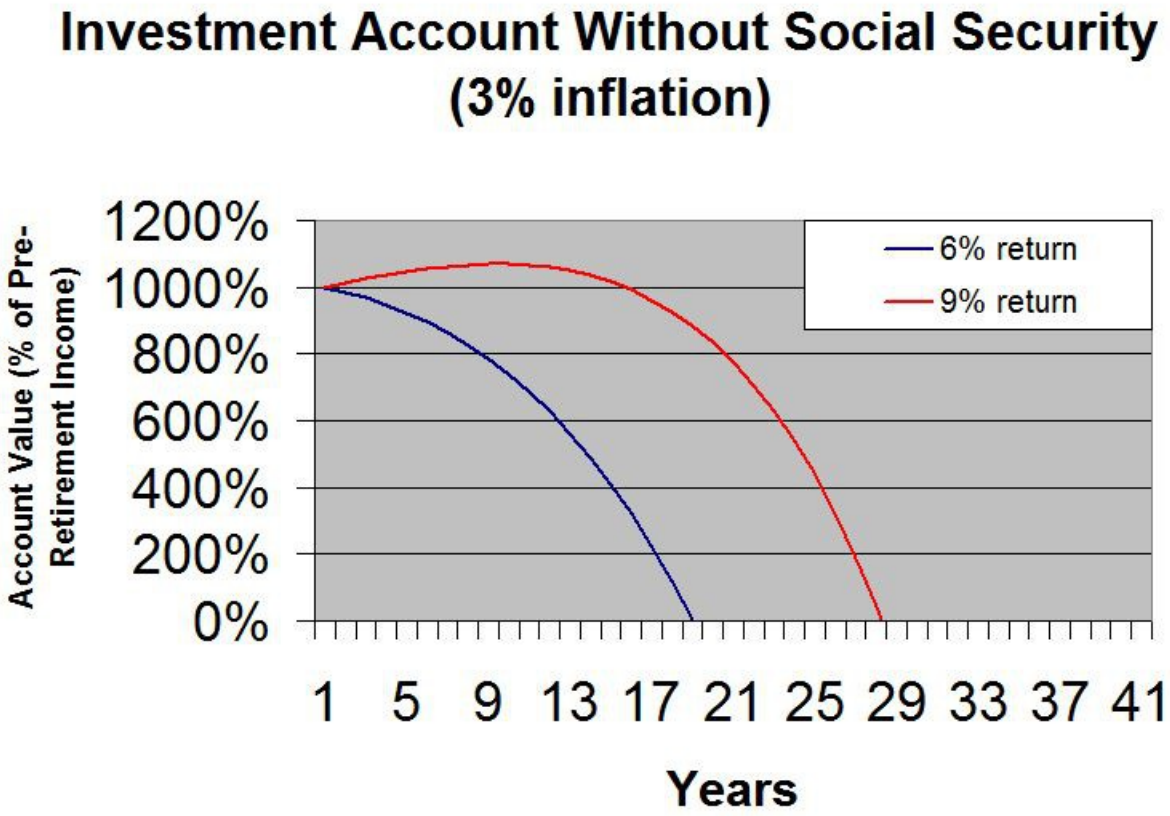
12) http://minnesota.cbslocal.com/2012/10/17/good-question-how-many-of-us-still-get-a-pension/
13) https://www.ssa.gov/planners/retire/r&m6.html

How Much Do You Need To Retire

The amount you need to retire depends upon the length of retirement, inflation rate and anticipated return on money used for retirement. For example, if you rely on 70% of you pre-retirement income during retirement and Social Security provides 40% of that, your investment account will need to provide the remainder. An account holding 10 times your pre-retirement income and returning 6% annually with 3% inflation (the historical long term average) will provide the needed amount for 40 years.



Unfortunately, there is persistent talk of cutting Social Security benefits. If you don't believe Social Security benefits will be there for you, the investment account would be depleted after 18 years. An investment account earning 9%, or 6% above inflation, would be depleted after 27 years.

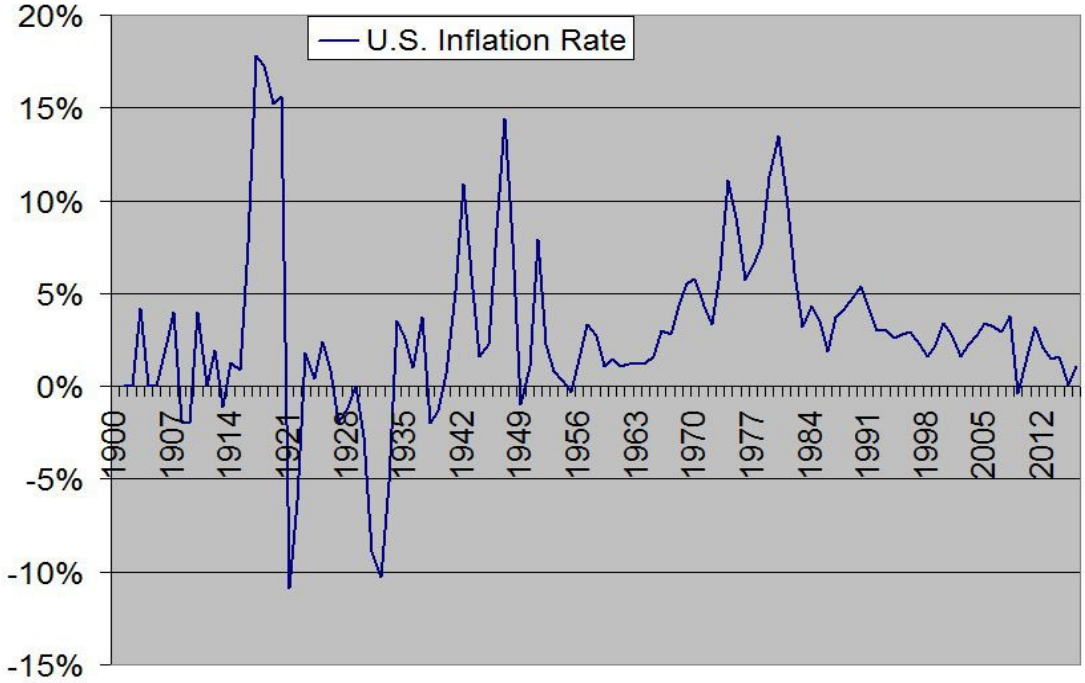


How much do you need to retire? If you believe at least some form of Social Security benefits will be available to you, a good answer would be <u>at least</u> 10 times your pre-retirement income returning <u>at least</u> 3% more than inflation.

Inflation - Your Biggest Worry

Assets need to grow above the inflation rate in order to grow at all. Inflation is the biggest worry when trying to grow assets for retirement. Future dollars get discounted, or become worth less, through inflation. Investors need to overcome the discounting of inflation in addition to achieving the desired growth.

The long term inflation rate is 3% (from 1900 through 2016), but inflation can vary dramatically. In fact, inflation has averaged over 4% over the last 45 years.



14)https://www.minneapolisfed.org/community/teaching-aids/cpi-calculator-information/consumer-price-index-and-inflation-rates-1913
15)http://www.in2013dollars.com/1903-dollars-in-2017?amount=1

Compounding Can Work For You Or Against You
Compounding occurs when the positive or negative return is dependent upon both the starting amount, or principle, as well as the return. Compounding works in your favor for positive returns in savings and investment accounts. Here the amount received is dependent on the total value of the account - including previous returns - and creates a positive growth function. Compounding works against you for credit cards where the amount you owe is dependent upon the total debt of the account - including previous charges and creates a negative growth function.

Credit cards are useful but charge exorbitant interest rates that work against your long term goals if you carry a balance.

The Nature Of Risk And Reward
There is a correlation between asset return and risk. When seeking higher return or reward you normally assume larger risks. We define risk by the volatility, or variability, of an asset's value. Let's compare the return and risk for the three most common asset classes: stocks (S&P 500), bonds (10-yr US Treasury) and cash (90-day T-Bill) from 12/31/71 to 1/31/17.

The annual return for these assets respectively is 10.39%, 7.4% and 4.91%.

The annualized volatility for these assets respectively is 15.2%, 7.1% and 1%.

Note that the inflation rate during this period of time was 4.02%. The inflation adjusted annual return over this period of time is 6.37% for the S&P 500, 3.38% for the 10-yr US Treasury and 0.89% for the 90-day T-Bill.

*Data from St. Louis Federal Reserve and Yahoo Finance

Investing To Meet Your Retirement Needs

You need to provide the bulk of your own income during retirement. Additionally, you would like the money set aside to be at least equal to 10 times your pre-retirement income and for the money to return at least 3% more than inflation during retirement. Unfortunately, it would take 47 years of annually saving and investing 10% of your income every year with a 3% return above inflation to achieve the goal of 10 times your pre-retirement income. If you started working when you were 25 years old, you would have to work until you were 72.

The time to achieve the investment goal of 10 times your pre-retirement income can be lowered by assuming more risk to achieve higher returns. It can be lowered to 40 years with a 4% return above inflation and 30 years with a 6% return above inflation.

From 12/31/71 to 1/31/17 the inflation adjusted annual return for the S&P 500 was 6.32%, for the 10-yr US Treasury it was 3.33% and for the 90-day T-Bill it was 0.84%.

It is clear that to meet your retirement needs you will need to start saving and investing early. You will need to save around 10% of your annual income into an investment account every year. Depending upon the time frame until retirement, you cannot invest too conservatively, but will need to invest in a portfolio of stocks and bonds or alternative assets with the appropriate allocation to achieve 10 times your annual income at the end of the time frame.

Four Steps To Financial Freedom
Here is an initial plan to get yourself into the best position to make your retirement a success.

1) Pay Off High Interest Debt
Good debt turns to bad debt when the debt interest rate exceeds after tax investment return . While after tax investment return depends upon risk assumed and overall tax rate, a reasonable assumption for this might be 6%. Average credit card rates are currently over 15% which is well over the threshold. Pay off credit card debt first.

2) Take Advantage Of Employer Sponsored Retirement Plan
If your employer sponsored retirement plan has low expense investment options and plan fees (less than 1% total), contribute up to the maximum allowed. Even if the retirement plan has high fees and expenses, contribute up to the company match, if offered. The extra expense you pay over the life of the plan will not offset the 100% up front return the match creates - which will put you ahead.

3) Build a Safety Net
It is important to meet your family's basic insurance needs such as health and life insurance. When purchasing these, unless there is a personal or family history, bet on good health and long life with lower cost plans. In addition to your insurance needs, build a cash, or low risk, highly liquid investment position of around 3-6 months of living expenses.

4) Fund an Investment Account
Allocate a consistent stream of cash into a low expense investment account. If you have a long enough time horizon, pursue a higher return or growth strategy and let compounding do its work. The rule of 72 is a useful shortcut to figure out how many years it takes for an investment to double. Divide 72 by the interest rate, or return, to get the number of years. A 6% return doubles in 12 years. A 9% return doubles in 8 years while a 12% return doubles in 6 years.

Part 3: Investing Primer

Investment Options

Investment is the action of purchasing something today, called an asset, and having it increase in value over time such that it is worth more in the future than it is today. The amount that the asset appreciates is called the investment return. For example, an asset that doubles in value appreciates 100%. The return is normally annualized for easy comparison so that we know what the annual return or annual growth rate is.

Compounding occurs when an asset creates a return which is reinvested in order to generate its own return. With compounding, the value of the investment increases exponentially. In fact, given enough time, the return generated on the reinvested money will surpass the return on the initial investment. This is why it is so desirable to invest early for retirement. For example, an asset returning 5% for 20 years returns 100% of the original investment without compounding. An asset compounding at 5% for 20 years will return 165%.

Investable assets, or asset classes, consist of stocks, bonds, cash equivalents and alternative assets.

Stocks are shares in ownership of a business. Some businesses pay money back to shareholders in the form of dividends. The return of a stock is the sum of the dividends paid plus the current value of the stock divided by the initial value of the stock. Certain indexes, such as the S&P 500, track a large percentage of the market of U.S. stocks. There are numerous other indexes that track other markets or pieces of markets. For example, MSCI EAFE index tracks international markets, while MSCI Healthcare tracks healthcare. Index Funds are designed to track certain chosen indexes with low expense.

Bonds are basically loans. The issuer of the bond pays the purchaser a specified interest rate over the life of the bond plus the original value of

the bond. Bonds can be issued by the government, municipalities, corporations or certain federal agencies. Treasury bonds issued by the government and backed by the full faith and credit of the US government have lower default risk and therefore lower interest rates than other bonds of equivalent length. Bonds' interest rate normally increases with bond length due to an increase in perceived risks such as default or inflation.

Cash Equivalents such as money market or treasury bills are characterized by high liquidity and less than three month maturity. These are considered to be the equivalent of cash.

Alternative Assets are assets other than stocks, bonds or cash and cash equivalents. These assets include real estate, commodities and precious metals.

Portfolio Considerations

The investment universe offers a lot of possibilities. The goal is to construct a portfolio which meets the investors requirements for both risk and reward.

Asset returns vary among the different asset classes. Additionally, the assets typically cycle from being undervalued where they have a higher future expected return and overvalued where they have a lower future expected return.

Volatility and maximum drawdown are measures of risk. Volatility refers to how much variability there is in the value of an asset. Maximum drawdown is the maximum amount the value of an asset has fallen from a peak. During the financial crisis in 2009, the S&P 500 bottomed with a 51% drop from its previous high. Some individual stocks lost 90% of their value or even went bankrupt. Individual stocks have the highest volatility and highest potential return while cash and cash equivalents have the lowest volatility and lowest return.

Investing in pooled assets such as mutual funds, Exchange Traded Funds (ETFs) and Real Estate Investment Trusts (REITS) can help to lower volatility. Additionally, investing in uncorrelated assets lowers volatility (see The Importance of Correlation).

When constructing an investment portfolio, the investor's goals, risk tolerance and time horizon control the asset selection and weighting.

Investment goals are unique to the investor. For example, some investors may prefer current income over capital appreciation. We define three investment goals for a portfolio: capital preservation, current income and growth.

The risk tolerance of the investor has a major impact on portfolio construction. People tend to feel losses greater than they feel equivalent gains. This is known as loss aversion (see Behavioral Finance). Imagine the pain felt with a 51% drawdown similar to that in 2009. U.S. stocks have periodically (1974, 1987, 2002, 2009) lost between 30% and 50% of their value. If these types of losses are unacceptable, a portfolio of 100% stocks is not desirable. We define three risk tolerances for a portfolio: conservative, moderate and aggressive.

The time horizon is important as well. If portfolio losses can be tolerated in the short term, but the portfolio value needs to be realized at a defined point in the future, it will affect portfolio construction. For example, the S&P 500's 2000 peak was not surpassed until 2006 when adding in dividends. We define three investor time horizons: short (0-5 years), medium (5-10 years) and long (>10 years).

Finally, once the goals, risk tolerance and time horizon are defined, combined with a basic understanding of probability and statistics the portfolio can be constructed from the various assets classes with appropriate weightings to meet the investment objectives.

Part 4: Basic Probability and Statistics You Need To Know

Understanding Probability Gives Confidence

Nothing is definite, the best thought out plans may falter, but you need a plan and you need confidence in the plan. Understanding the probability of events leads to confidence. What is the probability you will last and what is the probability your money will be there when you need it?

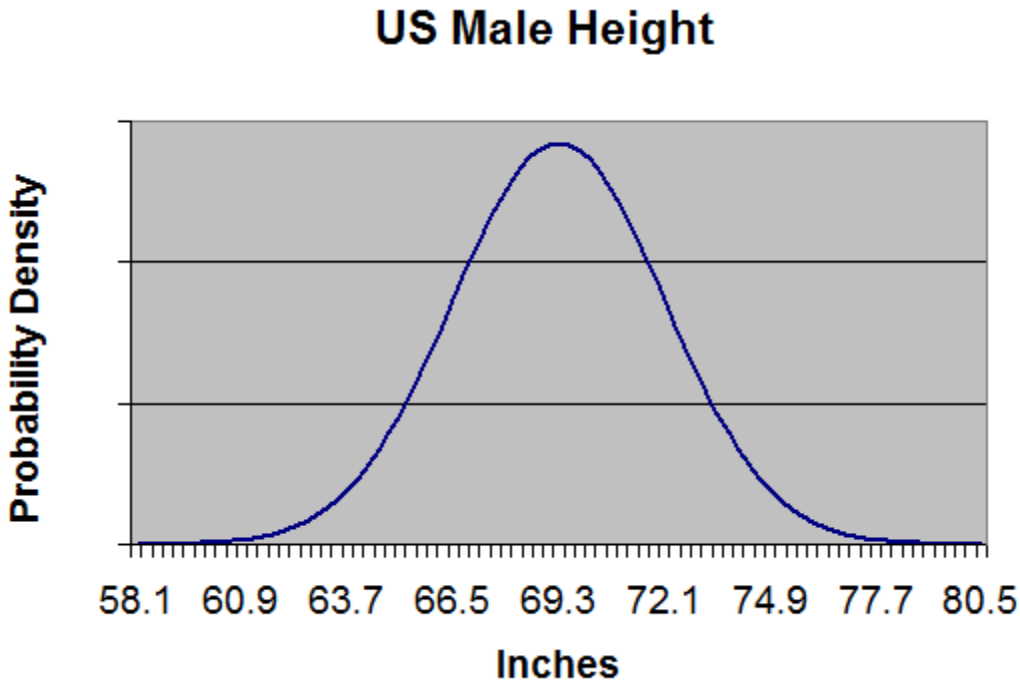
Whether you live 25 years after retirement is independent of whether your money will last 25 years after retirement but they both matter to you and are only important if they both happen together. Since the probabilities are independent they multiply together. If the probability of living 25 years after retirement is 25% and the probability of the money in an investment account running out after 25 years is 25% then the probability of them both occurring is (0.25)X(0.25) = 0.0625 or 6.25% which is one chance in 16. How confident would you be with a one in 16 chance of running out of money? This may not leave a lot of confidence for most people.

How confident would you be with a 1% chance (or one in 100) of running out of money in retirement? By targeting a lifespan of 30 years after retiring we lower the probability of living past the target to 10%. Additionally, targeting a 10% chance of our retirement portfolio running out in 30 years leaves a one chance in 100 of running out of money in retirement. (0.1)X(0.1) = 0.01 or 1%. A 99 out of 100 chance of success would leave the majority of people with a lot of confidence.

The Normal Distribution

In many natural processes, random variation conforms to a particular probability distribution known as the normal (Gaussian) distribution or bell curve. Some of these natural processes are height, weight, test scores, light bulb lifetime and the performance of a diversified investment portfolio.

Below is a normal probability distribution for the height of men in the United States. The mean or average height for men is 69.3 inches and the standard deviation is 2.8 inches. The standard deviation a measure of the volatility or dispersion of the data. A low standard deviation means the data is close to the average while a high standard deviation means the data is spread across a wide range of values.



Here are some characteristics of the normal distribution:

1) It is symmetrical about the mean. The probability of being above the mean is the same as the probability of being below the mean.

2) The curve is completely described by its mean and its standard deviation. Any normal distribution differs from any other normal distribution only by its mean and/or standard deviation.

3) The probability any data is within +/- 1 standard deviation of the mean is 68.27%. For the plot above this would be the probability the height is between 66.5 inches and 72.1 inches.

4) The probability any data is within +/- 2 standard deviations of the mean is 95.45%.For the plot above this would be the probability the height is between 63.7 inches and 74.9 inches.

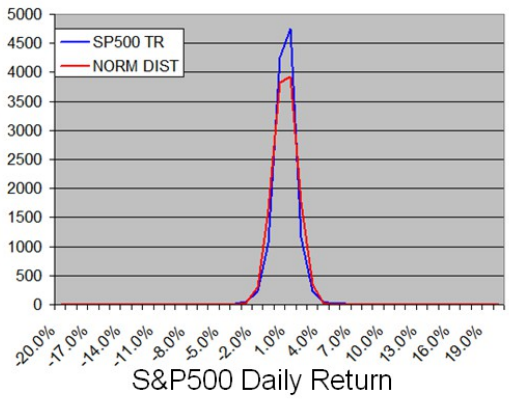
5) The probability any data is within +/- 3 standard deviations of the mean is 99.73%. For the plot above this would be the probability the height is between 60.9 inches and 77.7 inches.

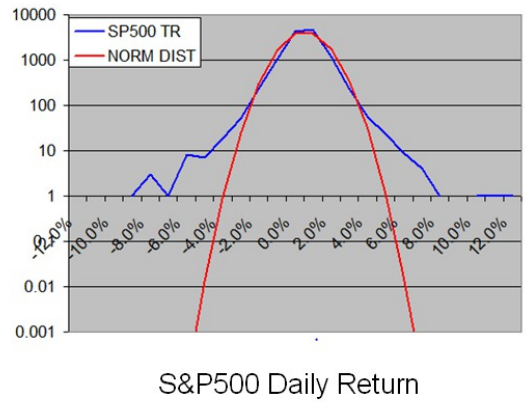
6) The total area under the curve is equal to the total probability and is therefore equal to one or 100%. The area under any portion of the curve is equal to the probability the data lies within that range. For the plot above, this implies that 100% of the males measured fits in the measured range and that the probability of a male measuring between say 72.1 inches and 74.9 inches is equal to the probability the height is above 72.1 inches (15.87%) minus the probability the height is above 74.9 inches (2.28%) or 13.6%.

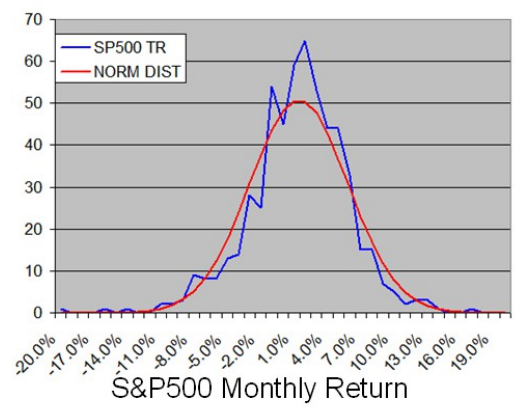
16) https://www.cdc.gov/nchs/fastats/body-measurements.htm
17) http://www.intmath.com/counting-probability/14-normal-probability-distribution.php

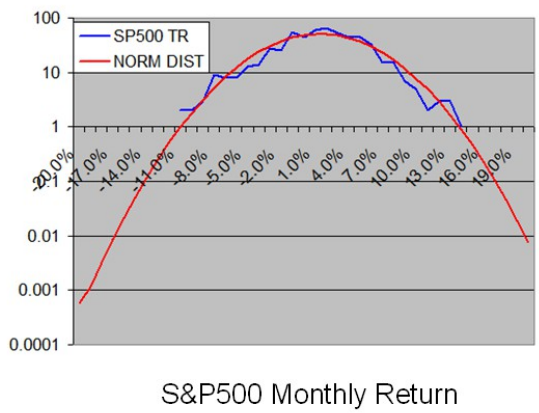
Are S&P 500 Returns Normally Distributed?

Does a normal distribution, or bell curve, accurately model returns for the S&P 500? Below are plots of 47 years of return data sorted by daily and monthly return plotted on a linear and log scale.









Another way to look at the data is by asking what is the error from the actual and expected number (for a normal distribution) of occurrences of returns outside a given range.

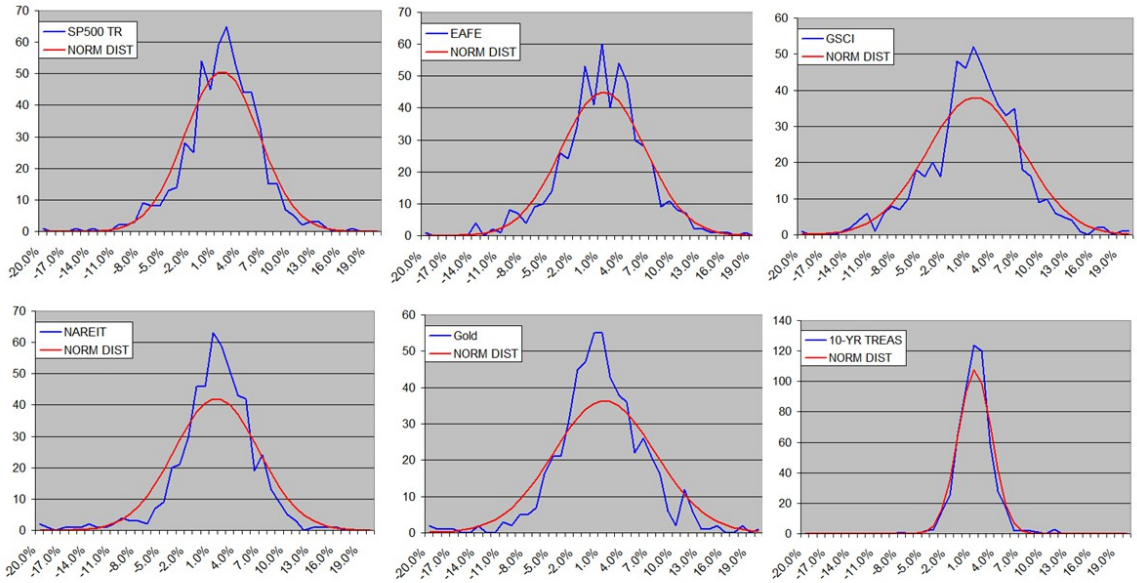
Daily Change	Occurrences	Expected	Error
> +/- 1%	1810	2486	37.4%
> +/- 3%	135	32	-76.3%
> +/- 5%	31	0	-100%
> +/- 9%	4	0	-100%

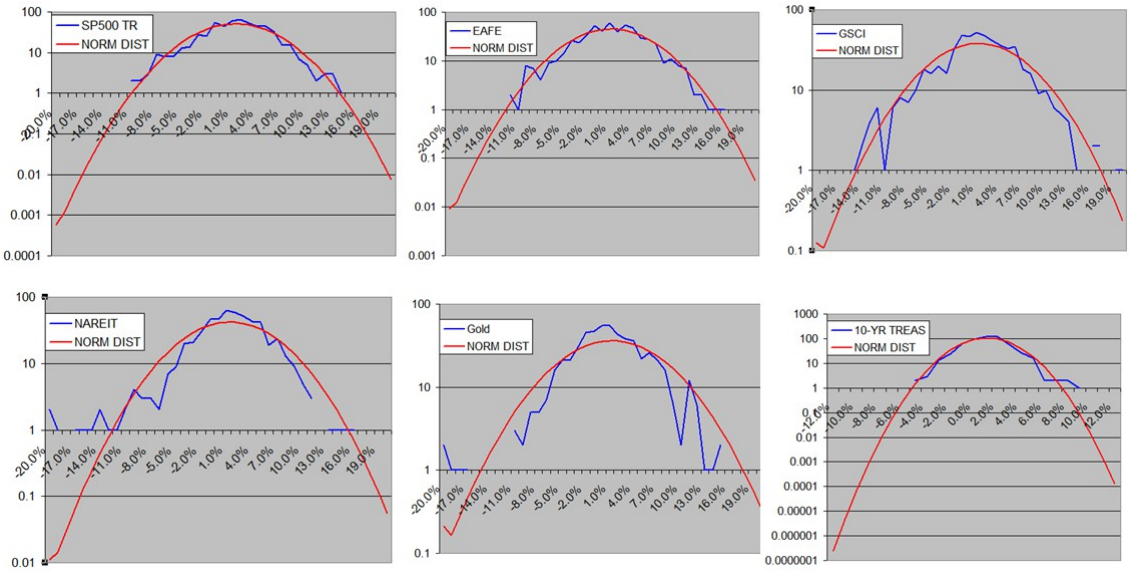
Monthly Change	Occurrences	Expected	Error
> +/- 1%	406	421	3.6%
> +/- 3%	235	254	8.2%
> +/- 5%	120	133	10.9%
> +/- 9%	22	23	3.3%

Conclusion: The monthly returns of the S&P 500 are fairly accurately described by a normal distribution. The daily returns of the S&P 500 do not follow a normal distribution.

Are Monthly Asset Returns Normally Distributed?

A normal distribution, or bell curve, fairly accurately models the monthly returns for the S&P 500. Let's examine some other assets to see if their monthly returns are normally distributed. Below are plots of 564 months (47 years) of return data for domestic stocks (S&P 500 TR), international stocks (MSCI EAFE), commodities (S&P GSCI), real estate (NAREIT), precious metals (Gold) and bonds (10-yr US Treasury) sorted by monthly return plotted on a linear and log scale. From the plots it is apparent that the normal distribution reasonable accurately models the monthly returns of these assets.



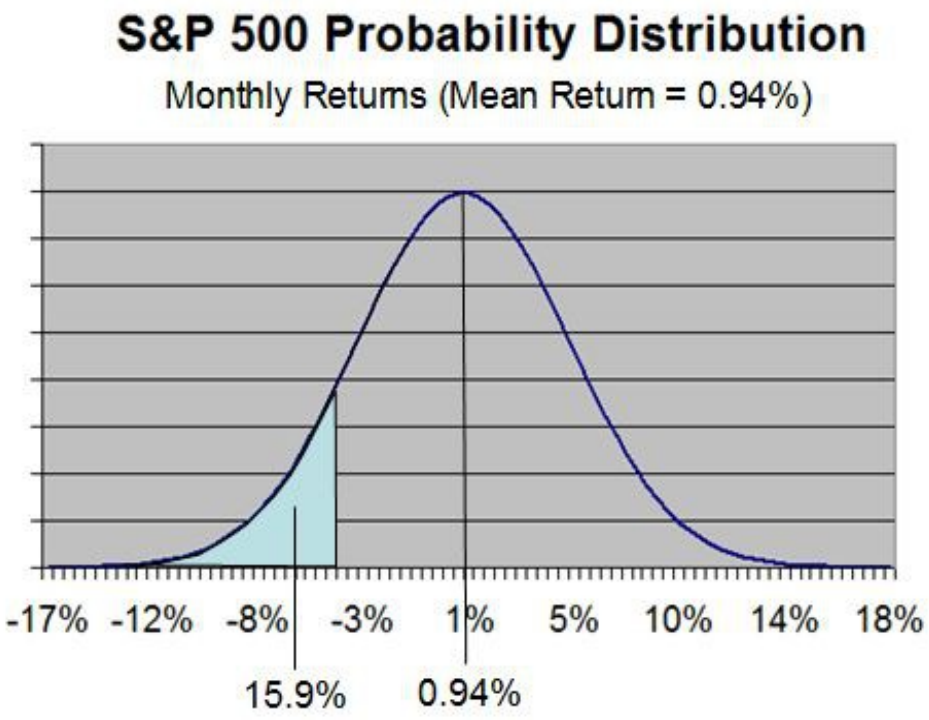


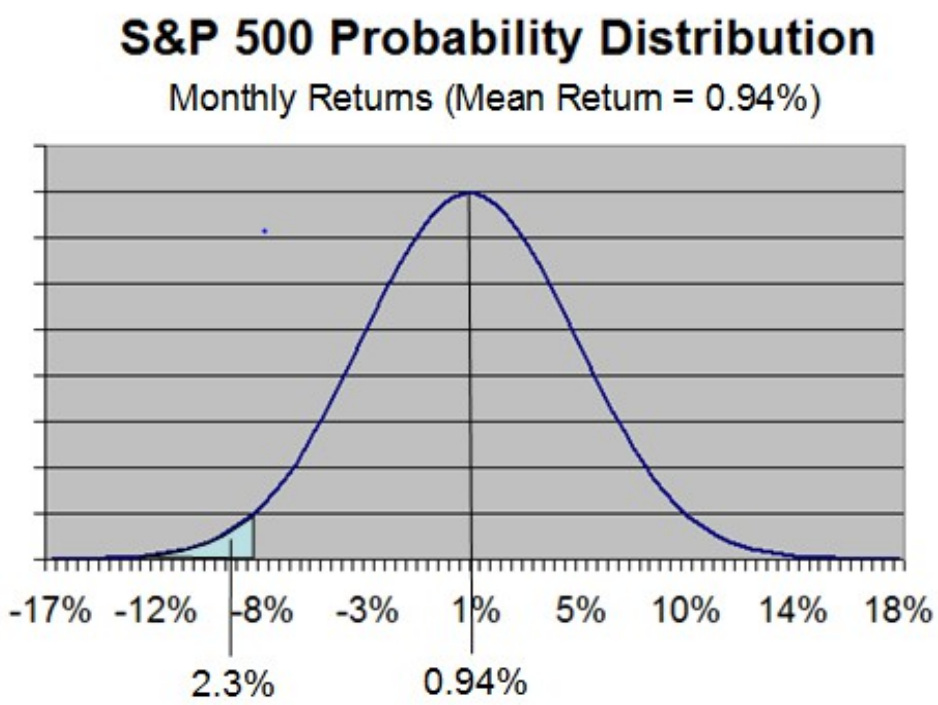
Define Your Risk

Investment portfolios have risk. Downturns occur periodically. Companies grow and mature. Some companies whither and die. Statistics can help you quantify your portfolio's risk.

If your portfolio is diversified enough that its monthly returns can be modeled as a normal distribution or bell curve, then statistics can be used to figure out the probability of different returns. Additionally, although the probability distribution is two sided, positive and negative, when talking about risk, the only concern is for the the negative side.

For example, the monthly volatility, or standard deviation, of the S&P 500 from 12/31/71 through 1/31/17 was 4.38%. The average monthly return during this time was 0.94%. If the S&P 500 is normally distributed then there is a 15.9% probability the monthly return will be lower than -3.4% (one standard deviation below the mean). There also would be a 2.3% probability the monthly return would be lower than -7.8% (two standard deviations below the mean) and a 0.14% probability, the monthly return would be lower than -12.2% (three standard deviations below the mean).





The Accumulation Of Risk and Return

From 12/31/71 through 1/31/17 the monthly return and standard deviation, of the S&P 500 was 0.94% and 4.38%. Monthly return is not random and therefore the expected return after 12 months is (1.0094)^12, or 11.88%. The variability in the monthly data is random and therefore the volatility, or standard deviation, accumulates as the square root of the sum of squares. The annual standard deviation is SQRT(12) times the monthly standard deviation or 15.17%.

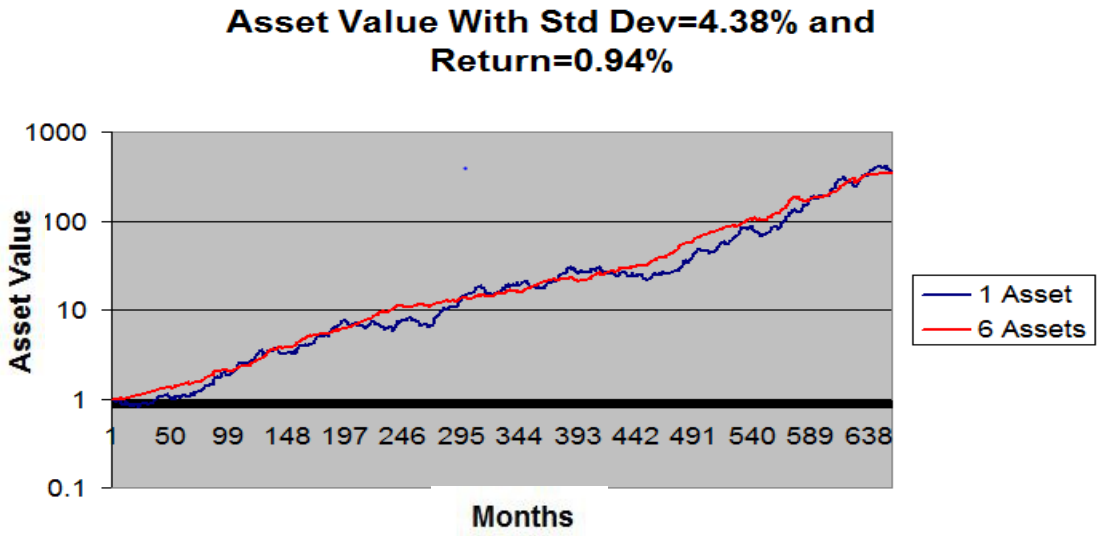
The expected return after 30 years is (1.0094)^360 or 2802.61%. The standard deviation after 30 years is SQRT(360)*4.38% or 83.1%. Since the returns follow a normal distribution, the probability of the actual return being one standard deviation below the expected return (2802.61% - 83.10% = 2719.51%) is 15.9%. The probability of being two standard deviations below the expected return (2802.61% - 2*83.10% = 2636.41%) is 2.3%. The probability of being three standard deviations below the expected return (2802.61% - 3*83.10% = 2553.31%) is 0.14%.

The Importance of Correlation

Correlation, or lack of correlation, is an important factor in portfolio construction. A portfolio constructed of two assets that have similar return and volatility characteristics, will have lower volatility than each of the individual assets if the assets returns are uncorrelated. This makes intuitive sense since as one asset moves up or down, the other asset will move up or down independently - thereby lowering overall volatility.
In fact, if each of the assets returns follow a normal distribution or bell curve, an equal capital allocation into the assets will lower the volatility by SQRT(2). An equal allocation into N assets will lower overall portfolio volatility by the SQRT(N).

The following figure shows a plot of a data set with the monthly volatility (standard deviation) and return (mean) equal to that of the S&P 500 from 12/31/71 through 1/31/17 compared against a theoretical portfolio of 6

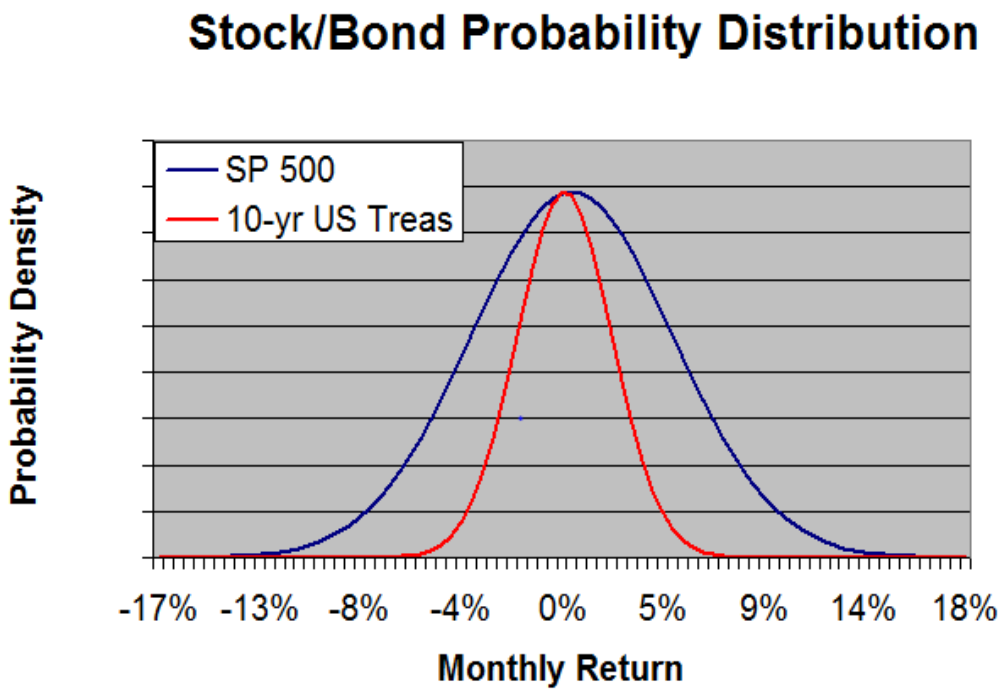
uncorrelated assets with volatility and return equal to that of the S&P 500. Please not that none of these data sets is the actual S&P 500 data. As expected, the volatility is reduced for the 6 asset portfolio by approximately SQRT(6) or 2.45.



Lower Your Risk

If 100% of your portfolio was invested in the S&P 500, you would have expected to experience a loss greater than -7.8% (two standard deviations below the mean) in one month 12 times (2.3% times 541 months) over the last 45 plus years or about once every 4 years. Individual companies and some other assets have even higher volatility than the S&P 500. Depending on your risk tolerance this type of risk may be too high.

Risk can be lowered through the selection of lower volatility assets. Bonds typically have lower volatility than stocks. For example, the 10-year US Treasury has a monthly volatility of 2.06% from 12/31/71 through 1/31/17. A portfolio constructed of 10-year US Treasuries would have less than half the volatility of the S&P 500 portfolio. Of course the drawback is that lower volatility assets typically have lower returns than higher volatility assets. For example, the monthly return of the 10-year US Treasuries is 0.62%.



Risk can also be lowered through diversification. Investing in multiple uncorrelated assets lowers volatility without sacrificing returns. For example, the S&P 500 and 10-year US Treasuries have a low correlation coefficient of 0.11*. A portfolio with 50% in each asset has a volatility of 2.52%. This is significantly lower than the 3.22% average of the individual volatilities.

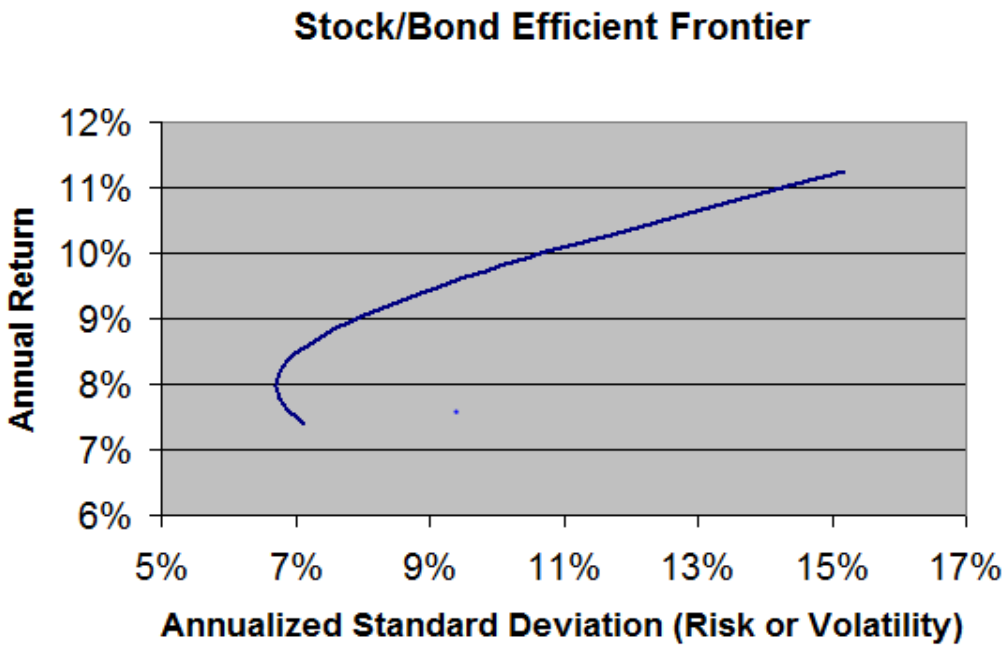
* Correlation coefficient measures the correlation between two sets of data. A correlation coefficient of 1.0 implies that the two sets of data are perfectly correlated. A correlation coefficient of 0.0 implies the two data sets are uncorrelated. A negative correlation coefficient implies a negative correlation between the two sets of data, they tend to move opposite to each other.

Modern Portfolio Theory

Modern Portfolio Theory attempts to manage and define portfolio risk. The theory focuses on the relationships of all assets in a portfolio and holds that risks can be lowered through selection of assets whose returns are not correlated.

The goal of Modern Portfolio Theory is to construct the most efficient portfolio from a set of assets. The most efficient portfolio gives the most return for a given amount of risk or the least risk for a given amount of return. The set of efficient portfolios constructed from a set of assets is called the efficient frontier.

Below is a graph of the efficient frontier for a mix of stocks (S&P 500) and bonds (10-yr US Treasuries) from 12/31/71 through 1/31/17. The efficient frontier is formed by sweeping the relative weighting of stocks with respect to bonds. An investor can choose his allocation based on where his risk/reward goals lie on the curve.



Part 5: Investing Strategies

Strategic Asset Allocation

Strategic asset allocation refers to allocating the assets in a portfolio into target allocations then rebalancing the portfolio periodically to maintain the original allocations. The allocations can be made in any way, but typically the allocations are made in a way to optimize return with respect to risk or risk with respect to return in such a way that the portfolio is kept on the efficient frontier.

How Often Should You Rebalance Your Portfolio

Periodically rebalancing your portfolio boosts overall return by selling temporarily outperforming assets and reinvesting into underperforming assets. If each asset displays similar long term gains, underperforming assets have higher future expected returns than outperforming assets. As the higher future expected returns are realized, overall portfolio performance is increased. Here is some annual return data from an equally weighted portfolio constructed of bonds, domestic stocks, international stocks, commodities, real estate and gold from 12/31/71 through 8/31/16. No rebalancing: 8.62%. Monthly rebalancing: 9.09%. Quarterly rebalancing: 9.36%. Yearly rebalancing: 9.86%. 2-year rebalancing: 9.55%. Clearly annual rebalancing improves performance the most - over 1% more than with no rebalancing at all.

Tactical Asset Allocation

Tactically allocated portfolios adjust the allocation to the assets in a way that seeks to improve upon the risk-adjusted returns of passive allocation investing such as Strategic Asset Allocation by dynamically allocating capital toward outperforming assets and away from underperforming assets.

Momentum is Real

The best estimate of an asset's near term future return is its recent past return. An alternative way of saying this is that bull and bear markets are real. Additionally, there is also clear empirical evidence of this in looking at the returns previously shown for different rebalance periods. This data showed improving performance by increasing the rebalance interval through one year. This implies that individual assets that are outperforming tend to keep outperforming through at least one year.

Investing in assets with positive price momentum naturally avoids assets experiencing bear markets thereby reducing portfolio risk and increasing returns.

One method of dynamically allocating capital to outperforming assets was outlined by Mebane Faber in his book, "The Ivy Portfolio". Faber used the 10-month moving average and whether the price was above or below the average as an indicator of positive or negative momentum. If an asset had negative momentum the asset would be liquidated and the funds invested in a cash equivalent (90-Day T-Bill). The net result of this approach was to improve overall performance and lower volatility.

Fundamental Analysis And The Efficient Market

Fundamental analysis for stocks reflects the idea that undervalued stocks can be found and invested in to create superior performance. In order for fundamental analysis to work, the market would have to be inefficient. The efficient market hypothesis maintains that all publicly known information is quickly reflected into the price of stocks and therefore markets are efficient. This theory is also referred to as the random walk theory and suggests that a random stock selection is as good as any other method. The semi-strong form of the efficient market theory uses the concept that enough investors attempt to use the publicly available information to their advantage that it creates a situation where no advantage ends up being available to anyone.

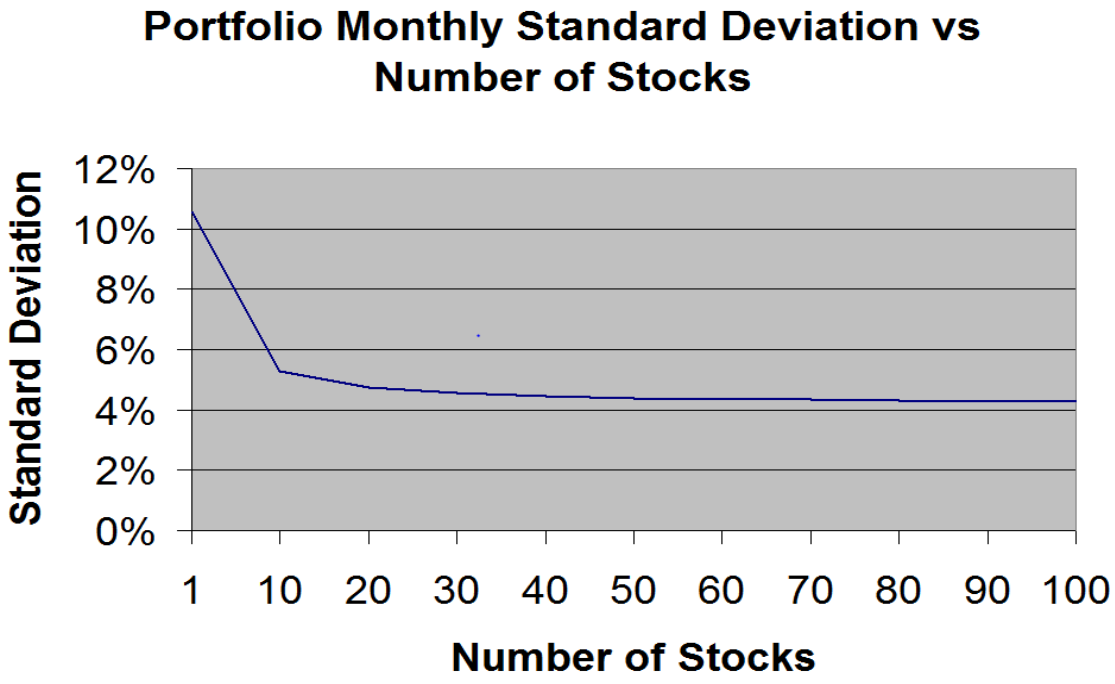
While the existence of asset bubbles, such as the dot com and housing, do not reflect an extremely efficient market, and it is true that some users of fundamental analysis such as Warren Buffet regularly outperform the market, it is also true that the majority of actively managed mutual funds underperform the market. The odds do not favor a successful fundamental analysis approach to investing over an efficient market approach.

18)https://www.fool.com/investing/2016/08/27/index-funds-vs-mutual-funds.aspx
19)http://www.lyxor.com/fileadmin/user_upload/pdf/Active_vs_passive_-_Septembre_2015.pdf
20)http://www.marketwatch.com/story/index-funds-beat-active-90-of-the-time-really-2014-08-01

The Problem With Fundamental Analysis For Individual Investors

When using fundamental analysis to determine if an investment would be worthwhile, a thorough understanding of the companies specific financial condition is performed relative to its peers. The goal is to determine if the current price of a company is less than the companies intrinsic value combined with its growth potential. Not only is a detailed financial analysis performed on each company as well as its peers, but economic trends, business conditions and management are investigated as well.

The analysis of each company and industry is detailed and time consuming. Additionally, since individual stocks are far riskier than the market, you will need a portfolio of stocks with sufficient quantity and diversification that it eliminates this excess risk – this excess risk is referred to as non-market risk. This implies a detailed understanding of multiple companies across multiple industries. How many companies does it take in a portfolio to eliminate non-market risk? A general estimate is around 20 or 30 stocks. Therefore, in order to construct a diversified portfolio of stocks using fundamental analysis you will need to research the financial condition and prospects of 20 to 30 stocks and their peers across multiple industries. This isn't feasible for the individual investor.



21)https://businessperspectives.org/journals_free/imc/2011/IMC_2011_2_Benjelloun.pdf

Technical Analysis And The Efficient Market

Technical analysis attempts to predict price changes based upon patterns in market data. Some of the most popular technical analysis patterns are given below:

Trendlines attempt to predict where a stock will go based upon where it has been, with the idea that a "trend is your friend" and will continue.

Support and resistance suggests where buyers and sellers lurk respectively. The idea is that previous areas of high trading activity will create support and resistance levels with traders looking to buy in or sell.

Breakouts occur when the price penetrates an existing support or resistance level an is followed by a rapid price movement in the same direction.

Moving averages are an average of price data. The two most popular averages are probably the 50-day and 200-day moving average. Prices crossing the moving averages or moving averages crossing each other can indicate a change in trend.

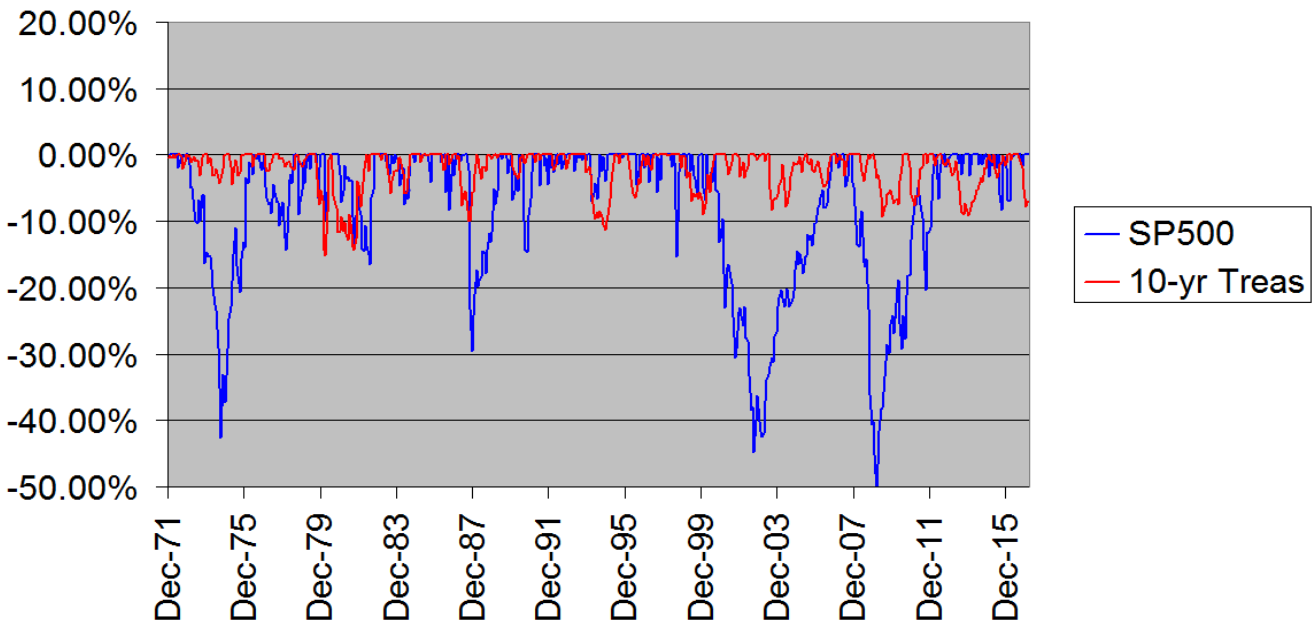
The efficient market hypothesis says that the success of technical analysis would be completely random because if it wasn't, enough people would continually use the same strategy which would destroy any chance of it being successful.

Part 6: Investment Portfolios

Building A Simple Portfolio

Once the asset universe is identified and investment goals, risk profile and time horizon are defined, the next step is to construct an investment portfolio. One of the most common portfolios is the stock/bond mix. The reason that the stock/bond portfolio is popular is that it utilizes two of the most common investments to construct multiple portfolios that meet different investment return and risk characteristics. Over the long term, stocks outperform bonds but have higher risk. Stocks can lose 40% or more of their value during a bear market. The figure shows the drawdowns for both stocks and bonds from 12/31/71 through 2/28/17.

Stock (S&P 500) and Bond (US 10-year) Drawdown



The return and risk characteristics are controlled by the relative weighting of stocks to bonds. In general, higher return and risk is associated with a higher weighting of stocks with respect to bonds. Here is the performance characteristics of a ratio of stocks (S&P 500) and bonds (10-yr US Treasury) from the same time period.

	100/0	80/20	60/40	40/60	20/80	0/100
Annualized Return	10.47%	10.09%	9.64%	9.09%	8.39%	7.39%
Maximum Drawdown	50.95%	45.31%	37.65%	26.64%	12.72%	15.12%
Annualized Volatility	15.16%	13.24%	11.22%	9.11%	7.19%	7.12%

ProFolio has utilized multiple assets within the investable universe to construct portfolios that meet different investment goals including capital preservation, income and growth. The return and risk characteristics of these portfolios are shown on ProFolio's website.

The Importance Of Alternative Assets

Alternative assets are assets other than stocks, bonds and cash equivalents. These assets include commodities, real estate and precious metals. Alternative assets are a useful addition to an investment portfolio due to their low correlation to traditional assets. Adding uncorrelated assets to a portfolio lowers portfolio volatility (see: The Importance Of Correlation).

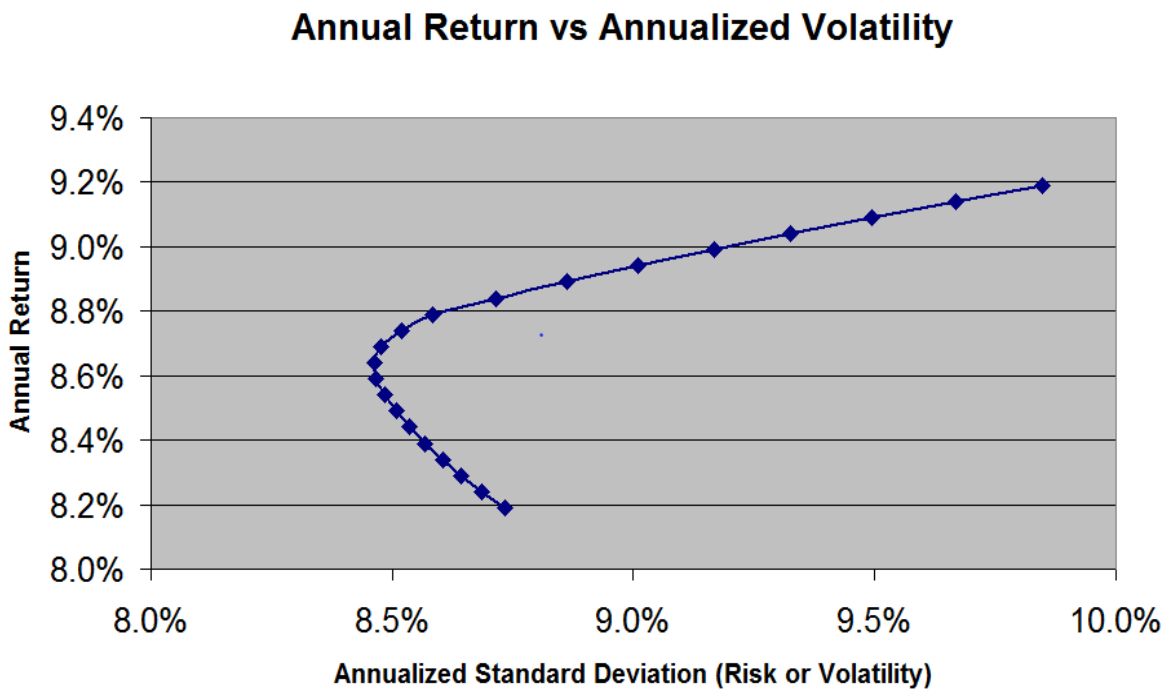
Here are the correlation coefficients from 12/31/71 through 1/31/17:

	Stocks (S&P 500)	Bonds(10-yr US Treas)
Commodities (S&P GSCI Index)	0.11	-0.15
Real Estate (FTSE NAREIT)	0.59	0.23
Precious Metals (Gold)	0.00	0.07

A Strategically Allocated Multi-Asset Portfolio

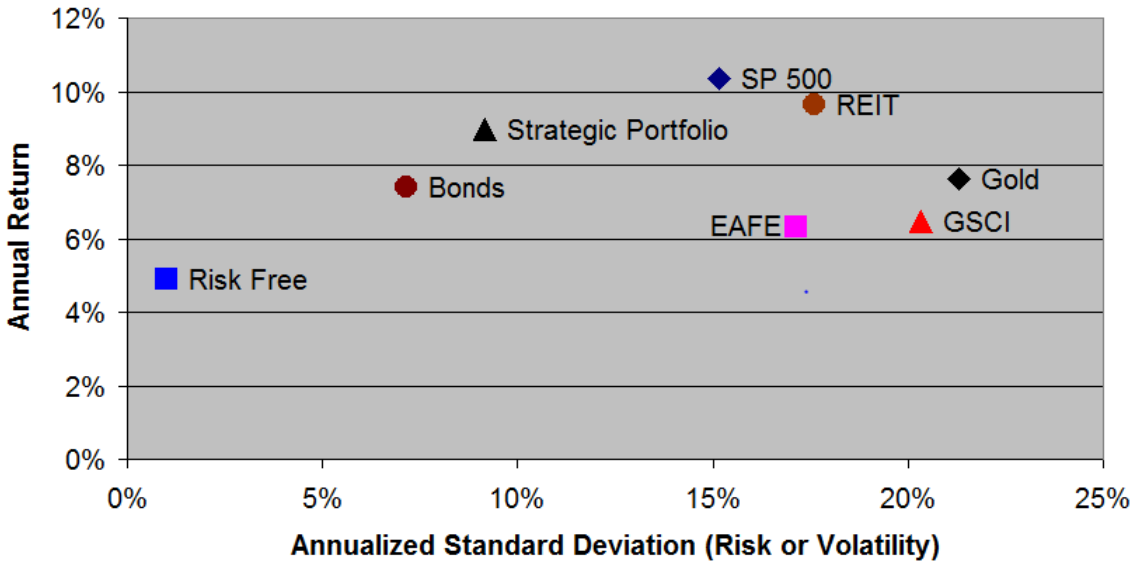
We can create a diversified portfolio by adding alternative assets to the stock/bond mix. The total portfolio consists of domestic stocks (S&P 500), international stocks (MSCI EAFE), bonds (10-yr US Treasuries), commodities (S&P GSCI), real estate (FTSE NAREIT) and precious metals (Gold). This portfolio is ProFolio's model Strategic Growth Multi-Asset portfolio.

In order to insure the overall portfolio remains on the efficient frontier, the risk is minimized for given returns using data from 12/31/71 through 2/28/17. The portfolio's results are net of ProFolio's management fee (0.5%), the custodial broker's custody/trading fee (0.25%) and tracking ETF expenses.



Strategic Portfolio Performance Measures

Plotting the portfolio's return and risk versus the return and risk of each of the individual assets shows how well this diversified portfolio improved return with respect to volatility or risk. For this analysis we chose an average return of 8.99% with a standard deviation of 9.17% on the efficient frontier.



The benchmark for the Strategic Growth Multi-Asset portfolio is an equal weighting of all of the portfolio's constituent components. The Strategic portfolio's modeled performance compared to its benchmark is shown below.

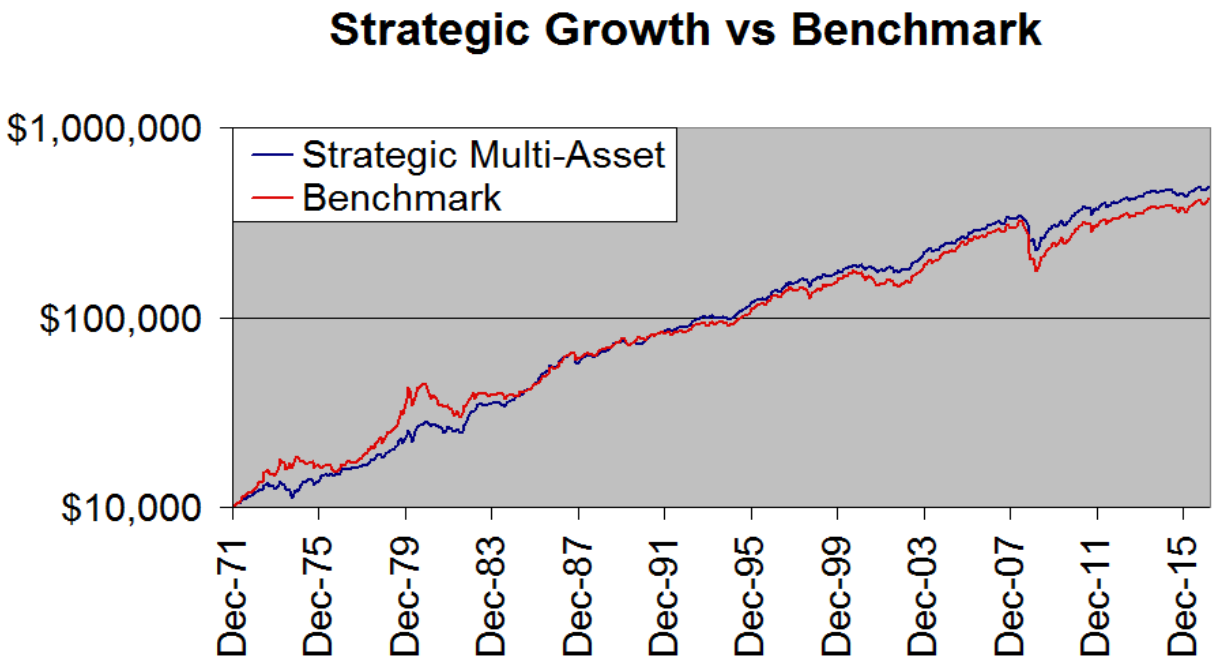
	Strategic Portfolio	Benchmark
Annualized Return	8.99%	8.62%
Annualized Real Return	4.97%	4.60%
Maximum Drawdown	35.54%	45.66%
Annualized Volatility	9.16%	11.85%
Sharpe Ratio	0.45	0.32

Sharpe ratio is a measure of return for a given risk. A higher Sharpe ratio implies higher risk adjusted return.

Sharpe ratio = (portfolio return - risk free return)/SQRT(portfolio return variance - risk free return variance)

Where the risk free asset is the 90-day T-bill and the variance is the square of the standard deviation (or volatility).

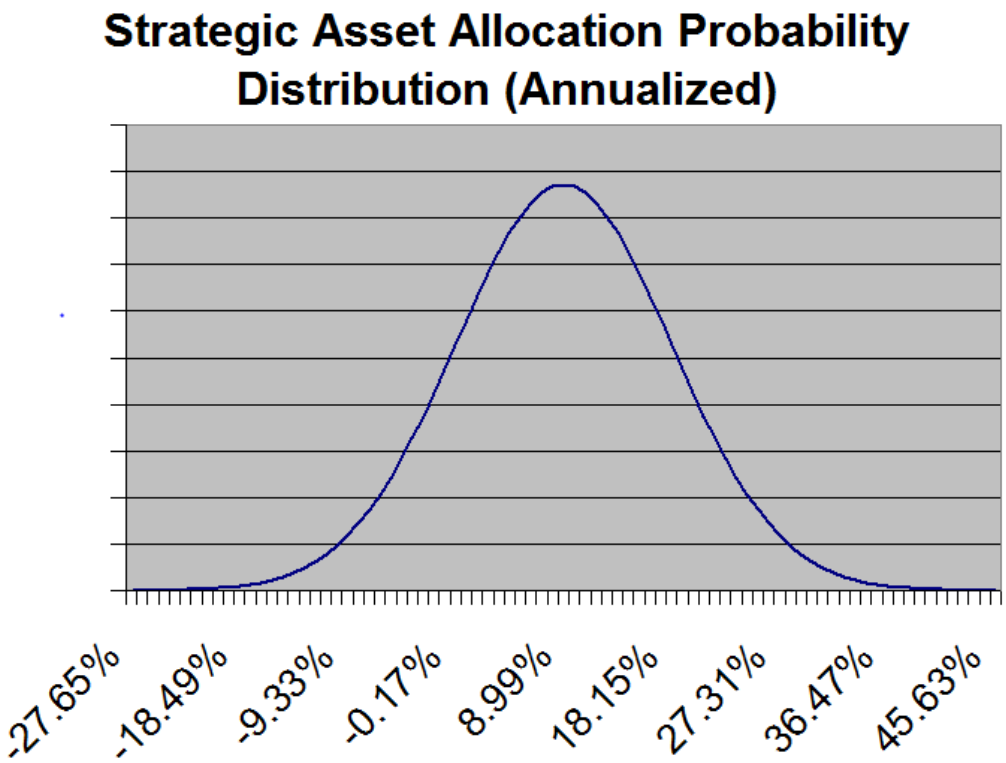
Here is the modeled growth of $10,000 invested on 12/31/71 in the Strategic Growth Multi-Asset portfolio compared to its benchmark.



Annual Downside Risk

What are the downside risks of the strategically allocated portfolio? Here is the annualized probability distribution function. Recall that the probability statistics showed that a return lower than one standard deviation below the average return would occur about 13.6% of the time or once every 6 years and a return lower than two standard deviations below the average return would occur about 2.3% of the time or once every 43 years. We selected the point on the efficient frontier where the average return of 8.99% with a standard deviation of 9.16%.

We would therefore expect a return below -0.17% once every 6 years and a return below -9.33% once every 43 years. In the portfolio's actual modeled performance, over 45 years of performance data there were 7 times (about once every 6 years) the portfolio returned less than -0.17% and one time the portfolio returned less than -9.33%.



Probability Of Meeting Retirement Goal

Recall, from How Much Do We Need To Retire, that the retirement goal was at least 10 times our pre-retirement income in an investment account. We calculated that if we put 10% of our annual income into an investment every year with a 4% return above inflation it would take 40 years and with a 6% return above inflation it would take 30 years to achieve this goal. In the strategically allocated portfolio we targeted a 8.99% return with an 9.16% standard deviation. The inflation rate over this period of time was 4.02% giving an inflation adjusted return of 4.97%.

After 40 years the average portfolio value is 11.99 times the pre-retirement income with a standard deviation of 3.01. The portfolio having a value below 10 times the pre-retirement income is 0.66 standard deviations below the average. The probability of the portfolio being below this is around 25%.

Below is a table showing how the portfolio value changes over the years as a multiple of pre-retirement income as well as the probability of meeting the 10 times pre-retirement income goal:

Years	Portfolio Average	Portfolio Standard Deviation	Probability of 10X Pre-retirement Income
30	6.61	1.52	1.3%
31	7.04	1.64	3.5%
32	7.49	1.76	7.7%
33	7.96	1.89	14.0%
34	8.46	2.03	22.3%
35	8.98	2.17	31.8%
36	9.52	2.32	41.8%
37	10.10	2.48	51.5%
38	10.70	2.64	60.4%
39	11.33	2.82	68.1%
40	11.99	3.01	74.6%

Probability Of Lasting In Retirement

How long will the strategically allocated portfolio last in retirement? The investment account starts with 10 times the pre-retirement income and a certain percentage is withdrawn from the account at the start of each year.

Here is a table showing the probability of the strategically allocated portfolio lasting a given number of years against the percentage of pre-retirement income withdrawn from the portfolio.

Years	80% Draw	70% Draw	60% Draw	50% Draw	40% Draw
15	96.3%	99.5%	99.9%	100%	100%
20	27.3%	86.8%	98.8%	99.9%	100%
25	0%	7.9%	83.8%	99.1%	99.9%
30	0%	0%	9.1%	93.0%	99.8%

From the above analysis it is apparent how important getting a percentage of your income from social security really is. If social security provides 40% of the projected 70% of pre-retirement income, or 28% of the pre-retirement income, the account will not run out of money. If there are cuts to social security or if it disappears entirely it will be difficult for the strategically allocated portfolio to provide entirely for retirement.

To meet a goal of having a 90% chance of not running out of money after 30 years we will need to lower the portfolio withdrawal rate to 59.9% of pre-retirement income. Alternatively, we would either need to withhold more than 10% of our income every year for retirement or move to a higher return/higher volatility placement on the efficient frontier.

Part 7: Tactically Allocated Portfolios

Tactically allocated portfolios attempt to improve on passively allocated portfolios by overweighting outperforming assets and underweighting underperforming assets.

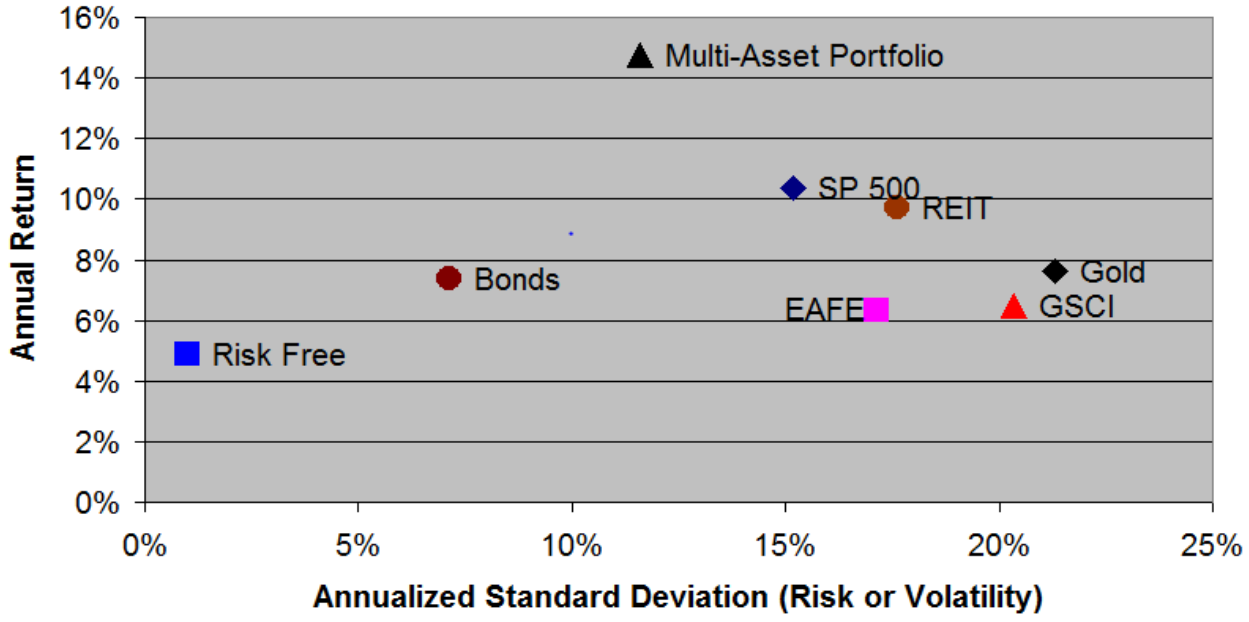
The model portfolios presented here vary along the risk and return spectrum in order to illustrate possible portfolio performance. Depending upon your attitudes towards risk and where you are on the path toward meeting your retirement goals it may be important to assume more or less potential risk and return.

All model portfolios' results are net of ProFolio's management fee (0.5%), the custodial broker's custody/trading fee (0.25%) and tracking ETF expenses.

The portfolio performance is typically measured from 12/31/71 through 2/28/17 except for portfolios utilizing emerging market bonds. These portfolios' performance is measured from 12/31/96 through 2/28/17 due to the formation of the J.P. Morgan Emerging Market Bond Index in the 1990s after the issuance of the first Brady bond.

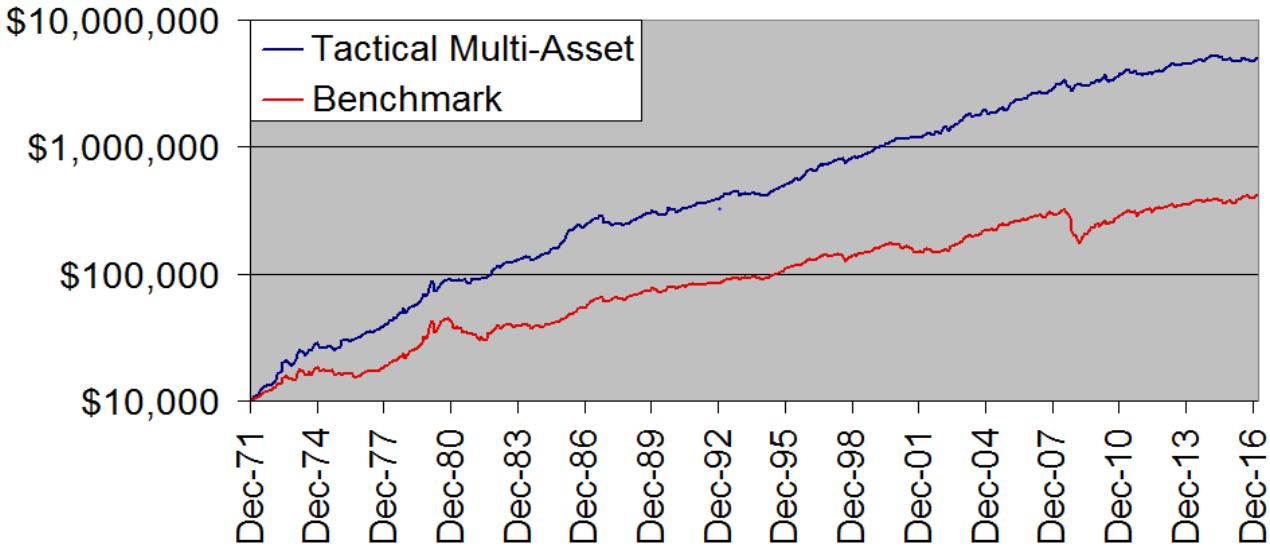
Tactical Growth Multi-Asset
Assets go through bull and bear markets. Uncorrelated global and alternative assets go through independent bull and bear markets. This portfolio targets the strongest markets. The portfolio consists of domestic stocks (S&P 500), international stocks (MSCI EAFE), bonds (10-yr US Treasuries), commodities (S&P GSCI), real estate (FTSE NAREIT) and precious metals (Gold).

The Tactical Growth Multi-Asset portfolio was constructed to outperform each of its constituent components. Here is a plot of the portfolio's return and volatility versus the return and volatility of each of the individual assets from 12/31/71 through 2/28/17.



The benchmark for the Tactical Growth Multi-Asset portfolio is an equal weighting of all of the portfolios constituent components. The portfolio's modeled performance compared to its benchmark is shown below along with the simulated growth of $10,000.

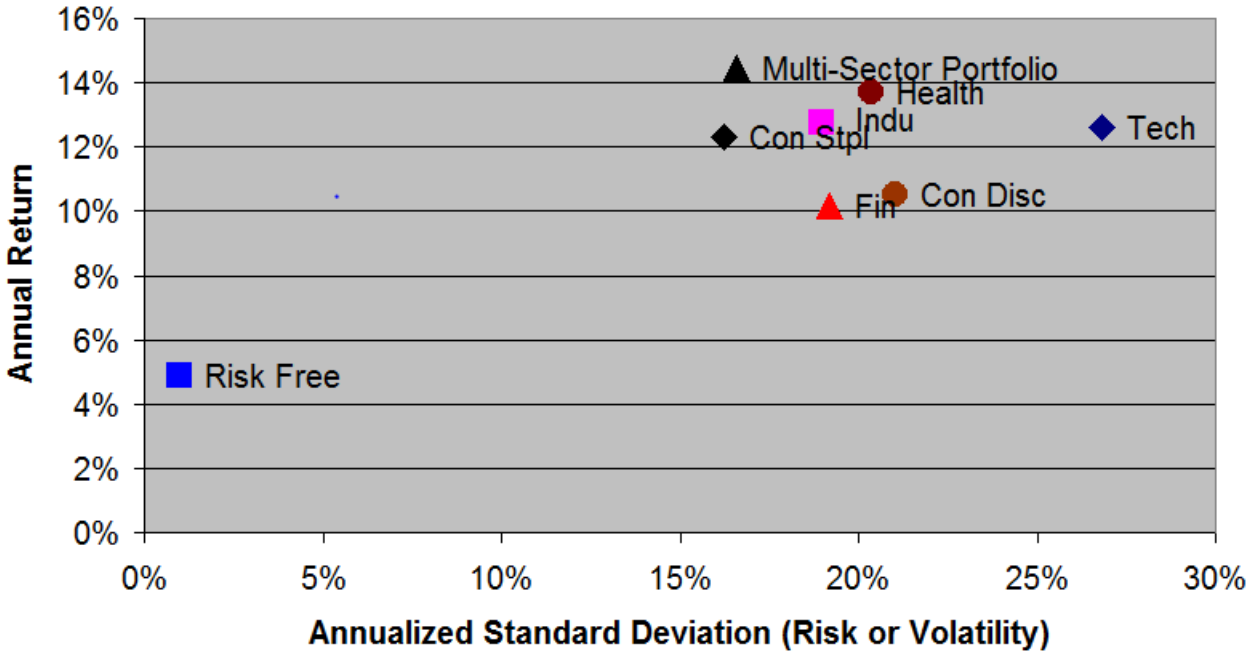
	Tactical Portfolio	Benchmark
Annualized Return	14.73%	8.62%
Annualized Real Return	10.71%	4.60%
Maximum Drawdown	18.42%	45.66%
Annualized Volatility	11.59%	11.85%
Sharpe Ratio	0.85	0.32



Tactical Growth Multi-Sector

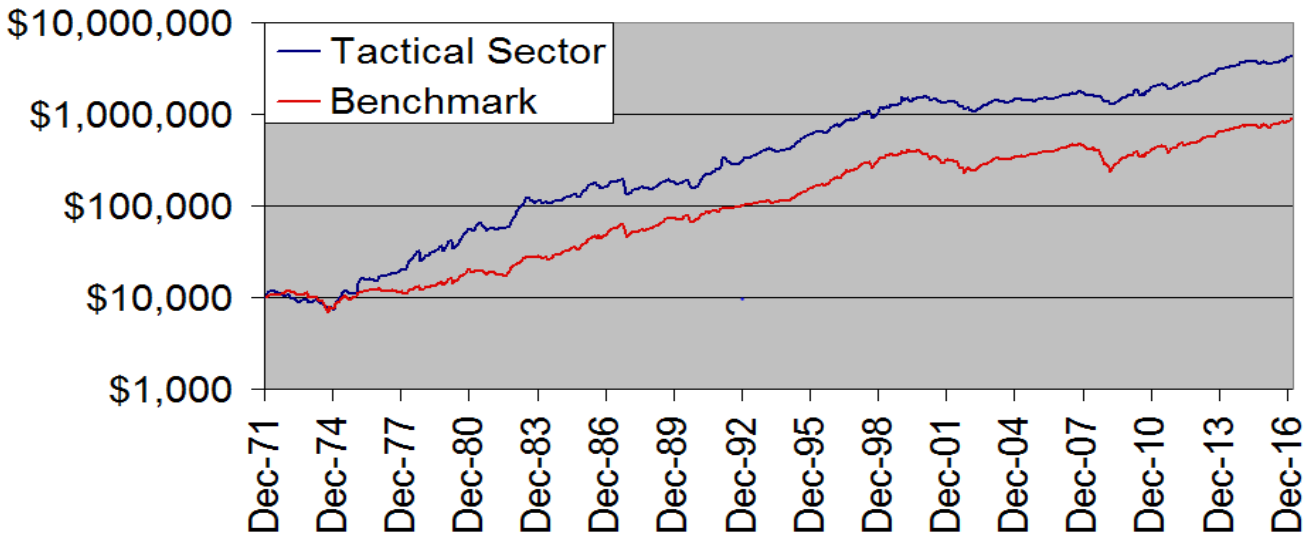
The stock market's return is a composite of many market sectors. Market sectors regularly outperform then underperform. This portfolio looks to find the strongest market sectors. The multi-sector portfolio consists of technology (MSCI Technology), industrials (MSCI Industrials), financials (MSCI Financials), consumer discretionary (MSCI Consumer Discretionary), consumer staples (MSCI Consumer Staples) and healthcare (MSCI Healthcare).

The Tactical Growth Multi-Sector portfolio was constructed to outperform each of its constituent components with an additional goal of outperforming the S&P 500 total return. Here is a plot of the portfolio's return and volatility versus the return and volatility of each of the individual assets from 12/31/71 through 2/28/17.



The benchmark for the Tactical Growth Multi-Sector portfolio is the S&P 500 total return. The portfolio's modeled performance compared to its benchmark is shown below along with the simulated growth of $10,000.

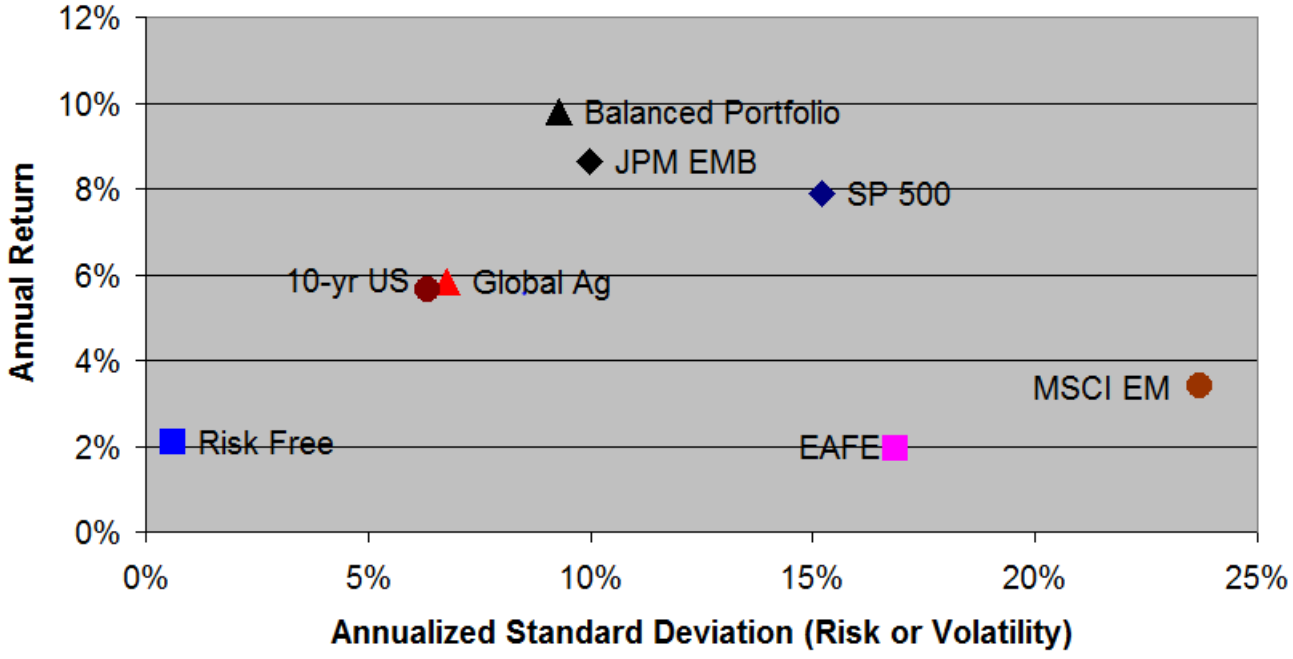
	Multi-Sector Portfolio	Benchmark
Annualized Return	14.44%	10.45%
Annualized Real Return	10.42%	6.43%
Maximum Drawdown	37.98%	50.95%
Annualized Volatility	16.61%	15.13%
Sharpe Ratio	0.58	0.36



Tactical Balanced

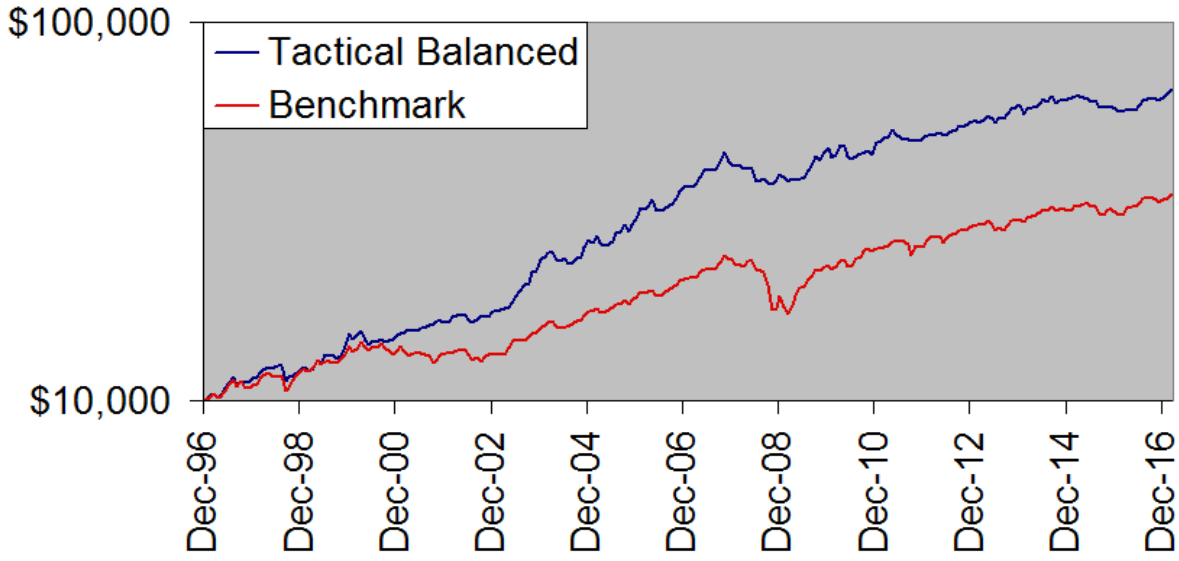
A balanced portfolio balances risk with return with an allocation between stocks and bonds. This tactical allocation strategy targets the higher returns of stocks with the lower risks of bonds. The portfolio is constructed using domestic stocks (S&P500), international stocks (MSCI EAFE), emerging market stocks (MSCI EM), domestic bonds (10-yr US Treasuries), international bonds (Barclays Global Aggregate) and emerging market bonds (JPM EMB).

The Tactical Balanced portfolio was constructed to outperform each of its constituent components. Here is a plot of the portfolio's return and volatility versus the return and volatility of each of the individual assets from 12/31/96 through 2/28/17.



The benchmark for the Tactical Balanced portfolio is an equal weighting of all of the portfolio's constituent components. The portfolio's modeled performance compared to its benchmark is shown below along with the simulated growth of $10,000.

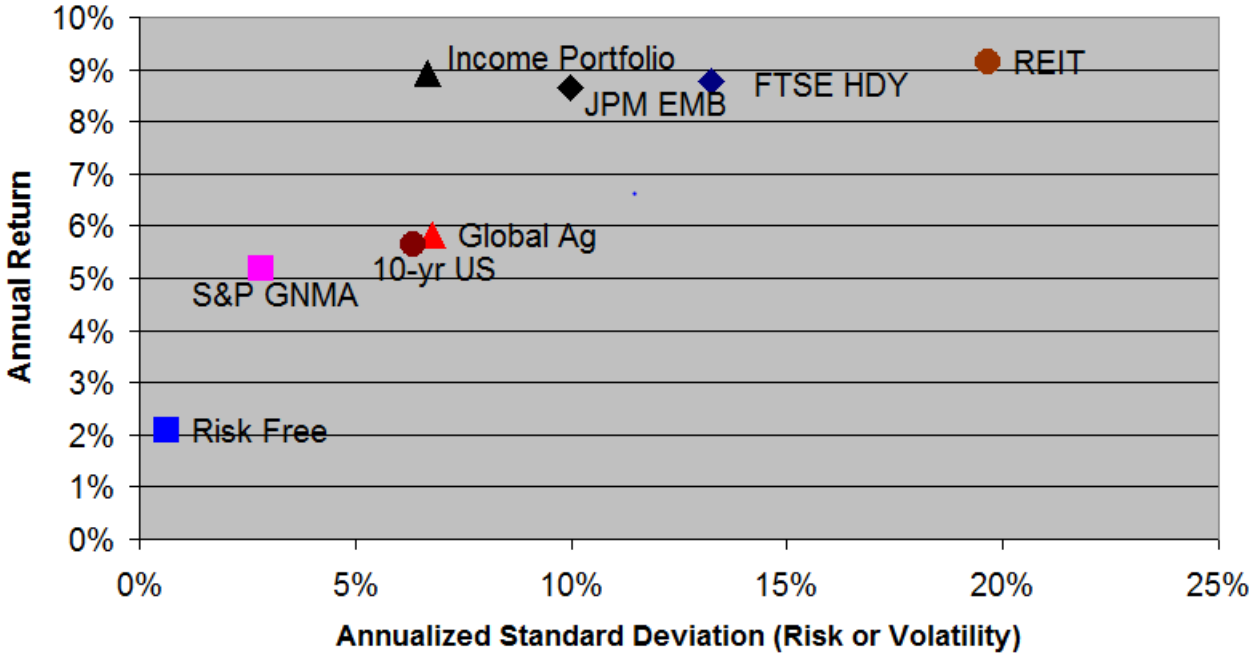
	Balanced Portfolio	Benchmark
Annualized Return	9.80%	6.39%
Annualized Real Return	7.66%	4.25%
Maximum Drawdown	17.75%	29.88%
Annualized Volatility	9.30%	8.96%
Sharpe Ratio	0.83	0.48



Tactical Income

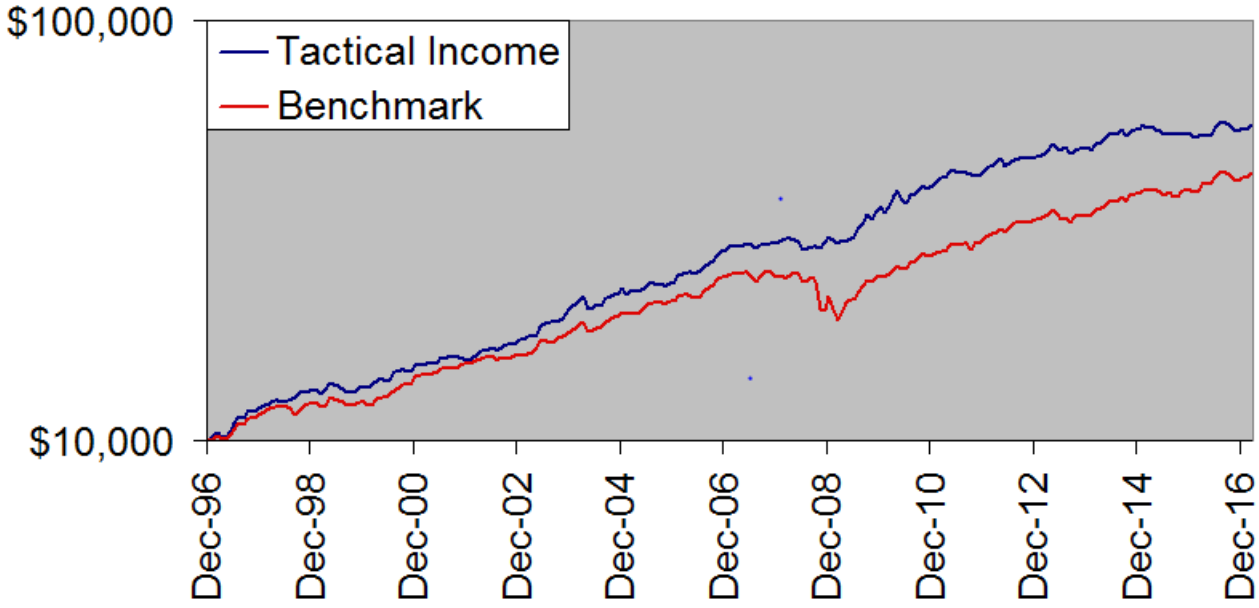
An income portfolio seeks to produce current income and maintain purchasing power. The portfolio is constructed using domestic bonds (10-yr US Treasuries), international bonds (Barclays Global Aggregate), emerging market bonds (JPM EMB), high dividend yield stocks (FTSE HDY), real estate (FTSE NAREIT) and mortgage backed securities (S&P GNMA).

The Tactical Income portfolio was constructed to outperform each of its constituent components. Here is a plot of the portfolio's return and volatility versus the return and volatility of each of the individual assets from 12/31/96 through 2/28/17.



The benchmark for the Tactical Income portfolio is an equal weighting of all of the portfolios constituent components. The portfolio's modeled performance compared to its benchmark is shown below along with the simulated growth of $10,000.

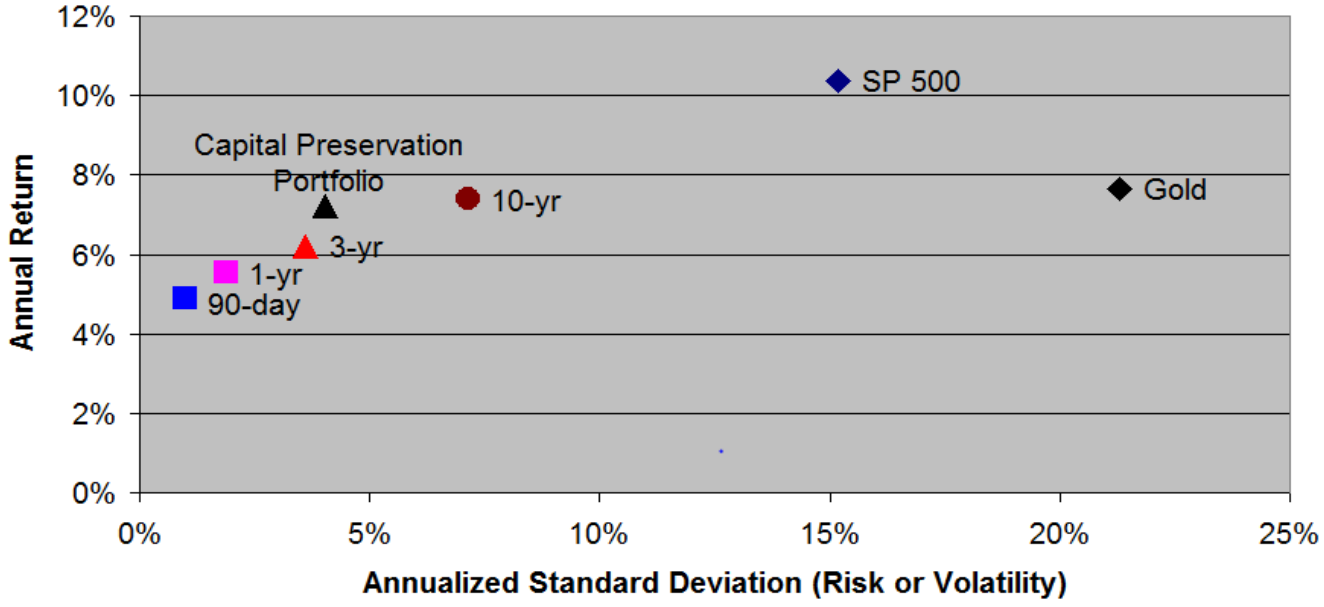
	Income Portfolio	Benchmark
Annualized Return	8.94%	7.51%
Annualized Real Return	6.80%	5.37%
Maximum Drawdown	7.47%	23.80%
Annualized Volatility	6.67%	7.17%
Sharpe Ratio	1.03	0.76



Tactical Capital Preservation

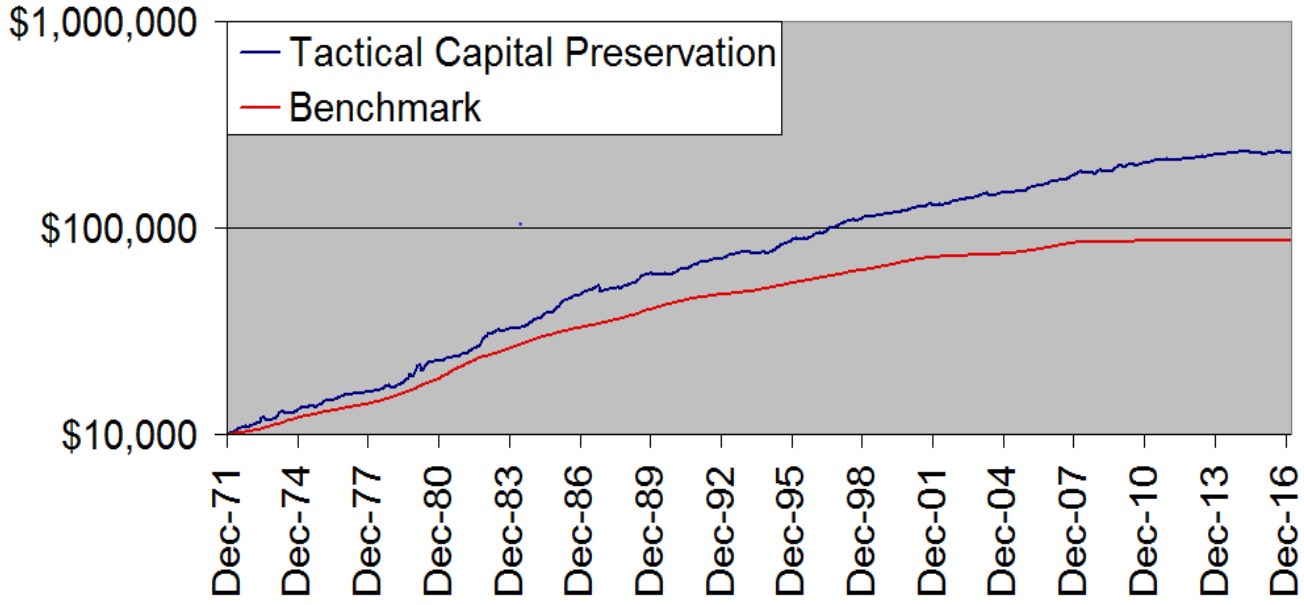
A capital preservation portfolio looks primarily to preserve capital with a secondary objective of preserving purchasing power. Bonds tilted toward a shorter duration preserve capital while assets with a positive correlation to inflation help preserve purchasing power. The portfolio is constructed using 90-day T-bill, 1-yr US Treasuries, 3-yr US Treasuries, 10-yr US Treasuries, S&P 500 and Gold.

The Tactical Capital Preservation portfolio was constructed to outperform the risk free rate of return (90-day T-bill) with low volatility. Here is a plot of the portfolio's return and volatility versus the return and volatility of each of the individual assets from 12/31/71 through 2/28/17.



The benchmark for the Tactical Capital Preservation portfolio is the 90-day T-bill. The portfolio's modeled performance compared to its benchmark is shown below along with the simulated growth of $10,000.

	Capital Preservation	Benchmark
Annualized Return	7.20%	4.89%
Annualized Real Return	3.18%	0.87%
Maximum Drawdown	5.22%	0.00%
Annualized Volatility	4.05%	1.01%
Sharpe Ratio	0.59	NA



Part 8: Portfolio ETFs

ProFolio model portfolios consist of Exchange Traded Funds (ETFs) selected to track their underlying asset class. The main selection criteria are low expense, liquidity and correlation to the asset they track. Fund expenses, lack of liquidity and failure to track the asset class will all negatively affect portfolio performance. The ETFs chosen are periodically evaluated for their suitability and are subject to change without prior notice.

Capital Preservation	Asset	Ticker	ETF Name
Money Market	90-day T-Bill	BIL	SPDR Bloomberg Barclays 1-3 Month T-Bill
Ultra Short Term Bond	1-year Treasury	SHV	iShares Short Treasury Bond (0-1 year)
Short Term Bond	3-year Treasury	BSV	Vanguard Short Term Bond (1-5 year)
Intermediate Term Bonds	10-year Treasury	BND	Vanguard Total Bond Market
Domestic Stocks	S&P 500	VTI	Vanguard Total Stock Market
Precious Metals	Gold	GLD	SPDR Gold Shares

Income	Asset	Ticker	ETF Name
Intermediate Term Bonds	10-year Treasury	BND	Vanguard Total Bond Market
Global Bonds	Barclays Glob Ag	BNDX	Vanguard Total International Bond
Emerging Market Bonds	JPM EMBI	VWOB	Vanguard Emerging Markets Bond
Real Estate	FTSE NAREIT	VNQ	Vanguard REIT
High Dividend Yield	FTSE HDY	VYM	Vanguard High Dividend Yield
Mortgage Backed Sec.	S&P GNMA	VMBS	Vanguard Mortgage-Backed Securities

Balanced	Asset	Ticker	ETF Name
Domestic Stocks	S&P 500	VTI	Vanguard Total Stock Market
International Stocks	MSCI EAFE	VEA	Vanguard FTSE Developed Markets
Emerging Markets	MSCI EM	VWO	Vanguard FTSE Emerging Markets
Intermediate Term Bonds	10-year Treasury	BND	Vanguard Total Bond Market
Global Bonds	Barclays Glob Ag	BNDX	Vanguard Total International Bond
Emerging Market Bonds	JPM EMBI	VWOB	Vanguard Emerging Markets Bond

Multi-Sector	Asset	Ticker	ETF Name
Technology	MSCI Technolog	VGT	Vanguard Information Technology
Industrial	MSCI Industrial	VIS	Vanguard Industrials
Financial	MSCI Financial	VFH	Vanguard Financials
Consumer Discretionary	MSCI Cons Disc	VCR	Vanguard Consumer Discretionary
Consumer Staples	MSCI Cons Stapl	VDC	Vanguard Consumer Staples
Healthcare	MSCI Healthcare	VHT	Vanguard Health Care

Strategic Multi-Asset	Asset	Ticker	ETF Name
Domestic Stocks	S&P 500	VTI	Vanguard Total Stock Market
International Stocks	MSCI EAFE	VEA	Vanguard FTSE Developed Markets
Commodities	S&P GSCI	PDBC	Powershares Diversified Commodity Strateg
Real Estate	FTSE NAREIT	VNQ	Vanguard REIT
Precious Metals	Gold	GLD	SPDR Gold Shares
Intermediate Term Bonds	10-year Treasury	BND	Vanguard Total Bond Market

Tactical Multi-Asset	Asset	Ticker	ETF Name
Domestic Stocks	S&P 500	VTI	Vanguard Total Stock Market
International Stocks	MSCI EAFE	VEA	Vanguard FTSE Developed Markets
Commodities	S&P GSCI	PDBC	Powershares Diversified Commodity Strateg
Real Estate	FTSE NAREIT	VNQ	Vanguard REIT
Precious Metals	Gold	GLD	SPDR Gold Shares
Intermediate Term Bonds	10-year Treasury	BND	Vanguard Total Bond Market

Part 9: Managing Your Investments

Dollar Cost Averaging

Dollar cost averaging is a method of purchasing individual assets or a portfolio of assets that uses fixed dollar amounts at regular intervals. The investor purchases more shares as the price is lower and less shares as the price is higher. The result is a lowering of cost basis over time compared to purchasing a fixed number of shares at regular intervals.

Here is an example of how this works. Suppose you make two purchases of an asset or portfolio of assets. At the time of the first purchase, the portfolio of assets has an average price of $90. At the time of the second purchase, the portfolio of assets has an average price of $110.

Using a constant share purchase plan, we purchase 100 shares at $110 and 100 shares at $90 for a total investment of $20,000 and an average cost basis of $20,000/200 shares or $100/share.

Using dollar cost averaging we purchase $10,000 at $90 for a total of 111 shares and then purchase $10,000 at $110 for a total of 91 shares. The average cost basis is $20,000/202 shares or $99/share.

Dollar cost averaging works and is simple to implement.

Behavioral Finance

People often make financial decisions that work against their long term goals. The study of this is called behavioral finance and was pioneered by Daniel Kahneman and Amos Tversky. The investor needs to recognize irrational behaviors and seek to avoid them.
Some of the irrational behaviors are:

Overconfidence: People tend to believe they are better investors than they truly are and tend to attribute random events to skill.

Biased Judgments: Confirmation bias is the tendency to interpret new data in a way that confirms existing beliefs. People may interpret new data to confirm their existing investment decisions. Hindsight bias is the tendency of people to overestimate their ability to have predicted an event which they could not possibly have predicted. Outcome bias refers to the tendency to judge a decision by the outcome instead of the quality of the decision at the time it was made.

Herding: This refers to the tendency for most people to get into the market near market tops and get out of the market near market bottoms which is evidenced by the percentage of equity allocation in funds.

Loss Aversion: People feel the pain of a loss more than they feel the joy of a gain. This causes people to make incorrect decisions about when to take losses.

Pride and Regret: People have the tendency to want to swell with pride at their successes and avoid regret at their failures. We associate success with skill and don't want the responsibility for failure. In investing this leads people to be reluctant to realize losses and eager to realize gains leading to selling winners too quickly and holding on to losing investments too long.

Part 10: Specific Actions To Take

Should You Max Out Your 401K?

With a goal of maximizing after tax returns, does it make sense to invest the maximum amount in a 401K or take this money after tax and invest in a taxable account?

Investing in a 401K with pre-tax dollars should have advantages over investing post tax dollars in a taxable account. One advantage is that gains in taxable accounts are subject to capital gain taxes. Another potential advantage is if the 401K distribution tax rate is lower than the current tax rate.

The disadvantages of 401K have to do with higher fees and underperformance of the limited investment options 401K plans typically offer.

According to the Center for American Progress, 401K plan administrative costs and investment expenses can total around 1% annually. 401K investment options vary by plan, but actively managed funds typically underperform passively managed funds. In 2015, Morningstar published a study showing that the average active U.S. large capitalization funds performance trailed the average passive performance by 0.82% annually.

With 401K plans lasting 20 years or longer the compounded effect of fees and underperformance is impossible for the advantages of 401K plans to make up. For example, the account value lost due to fees is 18.2% over 20 years. The account value lost due to underperformance is 15.2% over 20 years. Combining these effects together gives a portfolio loss of 30.7% over 20 years.

If your 401K plan offers low management fees and low expense investment options, stick with it. If not, contribute up to the employer match then look for a better investment option.

22)https://www.americanprogress.org/issues/economy/reports/2014/04/11/87503/fixing-the-drain-on-retirement-savings/
23)http://corporate.morningstar.com/US/documents/ResearchPapers/MorningstarActive-PassiveBarometerJune2015.pdf

Should I Pay Off My Mortgage?
The point at which debt interest rate exceeds after tax investment return is the point at which good debt turns to bad debt. While after tax investment return depends upon risk assumed and overall tax rate, a reasonable assumption for this might be 6%. Mortgage rates are currently below the 6% threshold. Adding in the mortgage interest expense reduction tax benefit reduces the effective interest rate further below the point at which good debt becomes bad debt. As long as you can achieve returns greater than the effective mortgage interest rate, hold onto your mortgage and put this money into your investment account.

Is A House A Good Investment?
From 1900 - 2012 house prices increased 3.1% annually while inflation averaged 3%. Historically, housing has appreciated just about 0.1% above inflation. Unfortunately, the average property tax rate is around 1.3% across the nation, 1% annually is used for house maintenance while around 0.35% annually is spent on home insurance. The net result of this is that housing costs approximately 2.64% per year. It actually makes economic sense to minimize housing costs.

Currently, mortgages are set such that a maximum of around 28% of your income before tax goes toward housing. An income of $100K can afford around a $360K house on a 30-year mortgage at 4.5%. At the end of 30 years the house would be worth around $900K using a 3.1% return. Total property tax, maintenance and insurance would be $485K yielding a total housing return before inflation of $54K.

Alternatively, suppose a $250K house was purchased instead with the

balance of the housing payment going into an investment account earning 6% annually. At the end of 30 years the house would be worth around $625K using a 3.1% return. Total property tax, maintenance and insurance would be $337K yielding a total housing return before inflation of $38K. The investment account, before tax, would have approximately $691K. A $675K improvement in net worth over the person with the more expensive house.

Conclusion: It is easy to wind up house poor by having too much of your cash flow tied up into your house. It is important for your long term financial well-being to have enough cash flow to support an investment account in addition to your house.

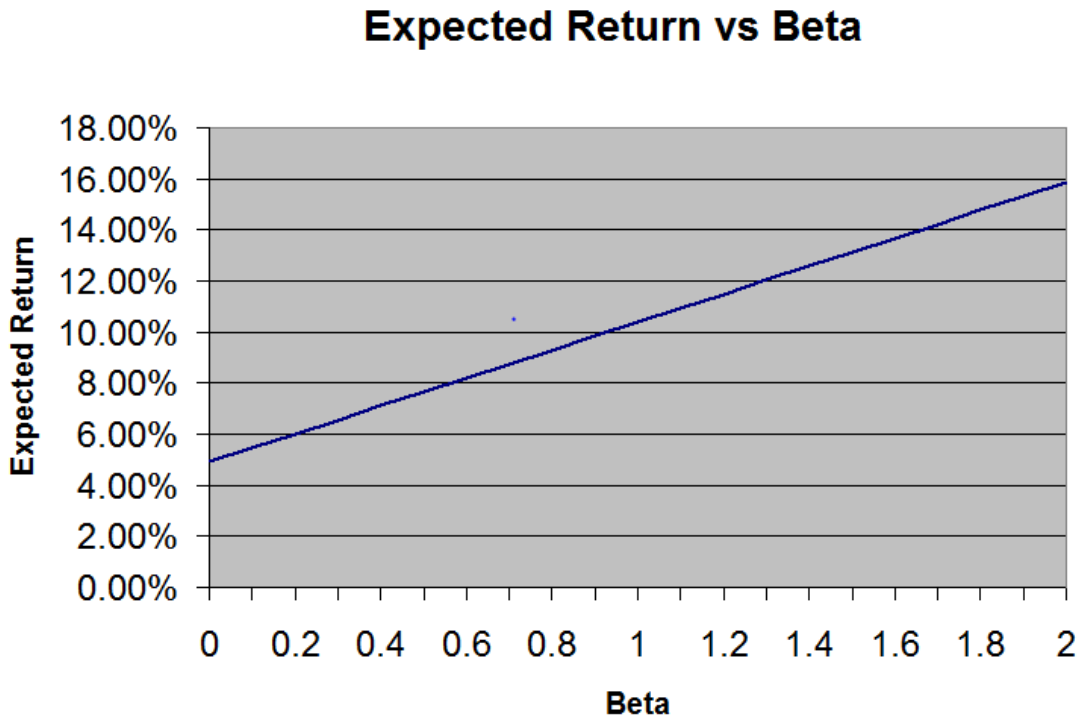
24) http://observationsandnotes.blogspot.com/2011/06/us-housing-prices-since-1900.html
25) http://realtormag.realtor.org/daily-news/2016/04/28/who-pays-highest-property-taxes
26) https://www.thebalance.com/home-maintenance-budget-453820
27) http://homeguides.sfgate.com/average-cost-homeowners-insurance-3020.html
28) http://www.bankrate.com/calculators/mortgages/new-house-calculator.aspx?wages=8333.00&investment=0&alimony=0&other=0&downPayment=0&term=30&interestRate=4.5&homeownerInsurance=1080&realstateTax=4900&carPayment=0&alimonyPaid=0&creditcardPayment=0&otherDebts=0&show=true

Can I Use Margin To Boost Performance?
Section 1: Capital Asset Pricing Model (CAPM) and Beta

The Capital Asset Pricing Model (CAPM) derives the expected return for an asset based upon the asset's systematic, or market, risk. CAPM assumes non-market, or unsystematic, risk can be removed through appropriate diversification. If an asset moves the same percentage as the market it has a beta of 1. If it moves proportional but greater than the market it has a beta greater than one and if it moves proportional but less than the market it has a beta less than one. This calculation expresses the expected return in terms of the market return, the risk free rate of return and beta.

Expected Return = Risk Free Return + Beta*(Market Return - Risk Free Return)

From 12/31/71 through 1/31/17 the Market Return as given by the S&P 500 was 10.39%. The Risk Free Rate of return as given by the 90-day T-Bill was 4.91%.



Portfolio returns can be increased by creating a portfolio with a beta greater than one, which leads to the possibility of creating a portfolio of high-beta stocks or using margin to create leverage and thereby increase beta.

Section 2: Beta And The Cost Of Margin

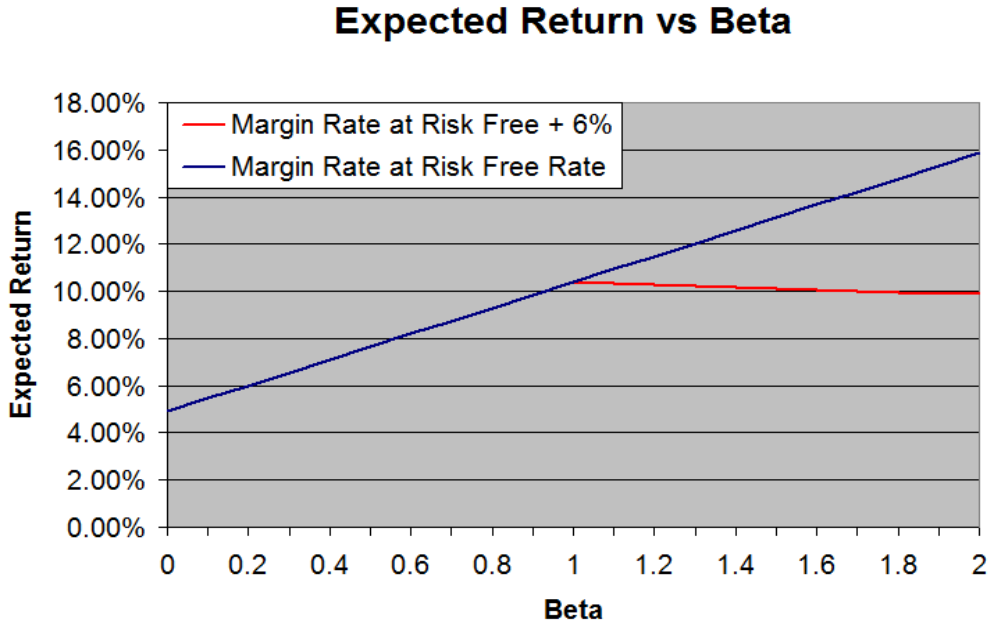
What is the cost of using margin in an account to boost returns by boosting beta? In a margin account you can borrow up to 50% of the purchase price of marginable assets. This allows investors to potentially

double the amount of assets they could buy.

The risk free rate of return is currently very close to zero (around 0.75%). In theory you could use margin to boost beta to nearly 2.0 and thereby boost your expected return. The biggest problem with this plan is that the cost of margin is not zero or even the risk free rate. The current base rate for margin at the largest discount brokers is 6.75%, which is 6% above the risk free rate.

The risk free rate (90-day T-bill) from 12/31/71 through 1/31/17 averaged 4.91%. If you assume in the past that the margin rate was 6% above the risk free rate you would have needed a return greater than 10.91% to improve your return by increasing beta. Unfortunately, the market return (S&P 500) during this period of time was 10.39%. You would effectively lower your return by using margin to buy the S&P 500 with today's cost of margin at 6% above the risk free rate.

The Capital Asset Pricing Model can be replotted with the margin rate at 6% above the risk free rate.



Section3: Beta And The Problem With Leverage

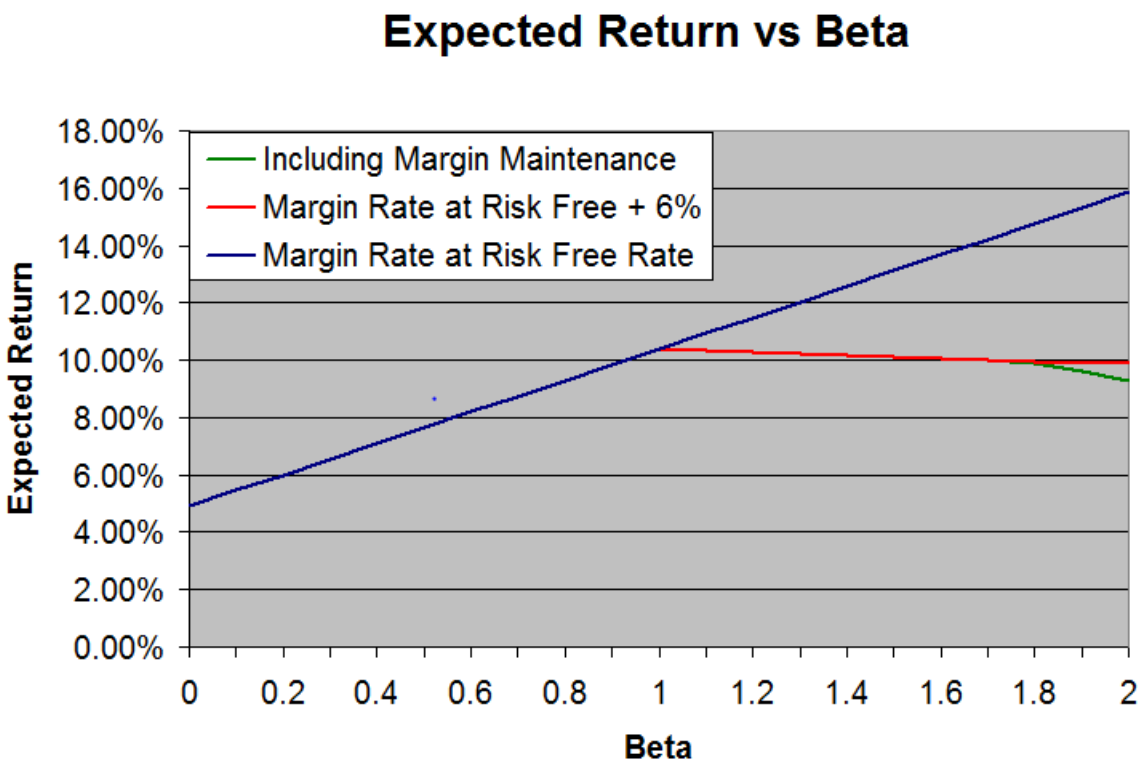
Another potential problem of using margin to create leverage in an account to boost returns by boosting Beta is the problem of market drawdowns. The maximum margin debt to account value is 50%. This would give a beta of 2. The account equity is the account asset value minus the margin debt. There is a minimum margin maintenance requirement of 30% account equity to account value. Periodically the market as defined by the S&P 500 has lost 40% or even up to 50% of its value. If an account using the maximum amount of margin experienced a 50% drop in account value the account equity would be zero. Wiping out your equity.

Brokerages have a minimum margin maintenance requirement of around 30% account equity to account value. When the ratio of account equity to account value falls below 30% the account holder is expected to make up the difference between the account equity and the required equity.

In the case where the account value fell 50%, there would be a margin maintenance call for additional capital worth 30% of the existing account value. If the funds were not provided, the margin clerk would sell assets in the account, locking in big losses, to get to the required account equity.

At maximum margin, a 50% loss locks in a loss of 15%, while a 40% loss locks in a loss of 5.3% when equity in the account is sold to satisfy the margin maintenance call. Since 12/31/71, there have been two instances of 40% losses and one instance of a 50% loss. This would result in a total loss of around 23.82%. This represents an annual loss of 0.6%.

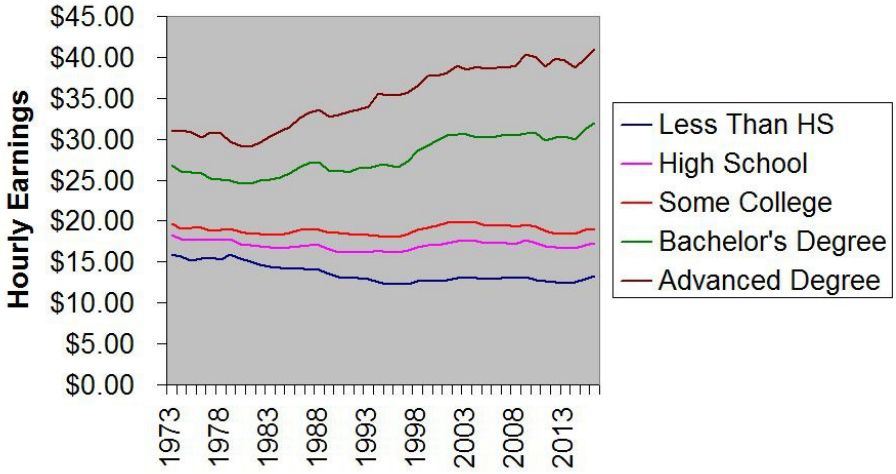
The Capital Asset Pricing Model can be modified to include the effect of margin maintenance.



Is A College Degree A Good Investment?

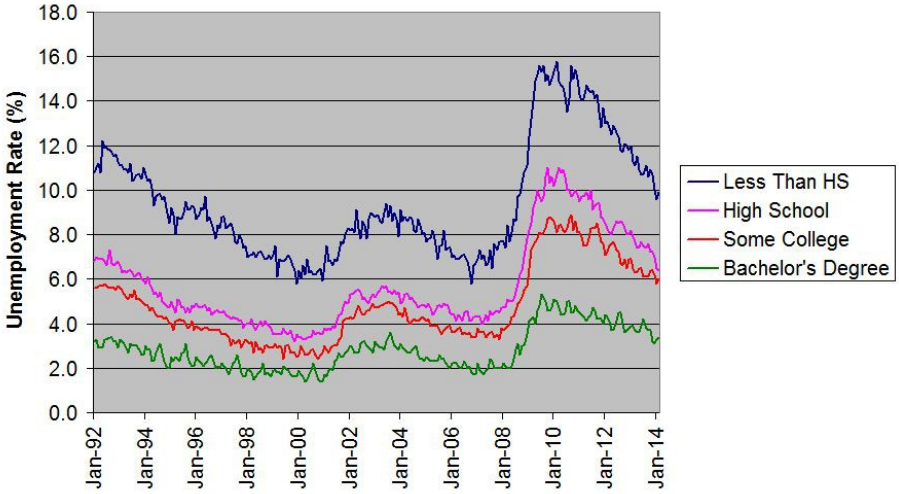
Section 1: Education Level Correlates With Income and Employment

Most people work for companies looking to make a profit. These companies attempt to hire people that will help them achieve their goals. As a worker, having skills that companies need will keep you in demand and help you get a higher salary. There is a correlation between education level and income level.



6)http://www.epi.org/data/#?subject=wage-education

There is also a correlation between education level and employment level.



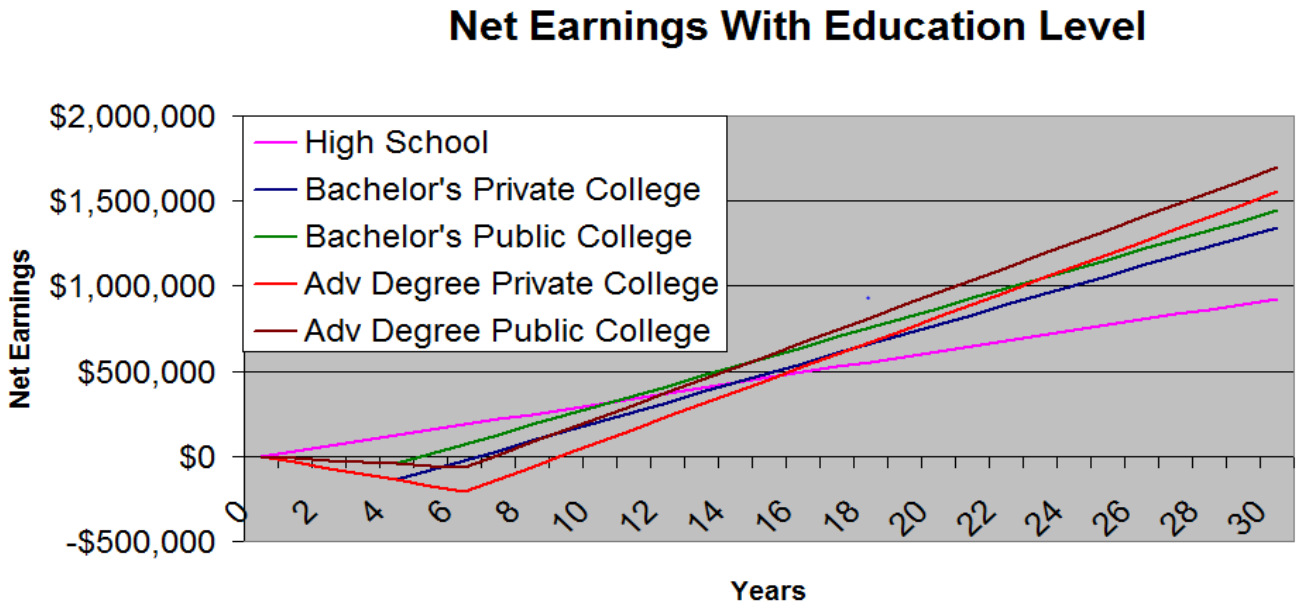
7)https://fredblog.stlouisfed.org/2014/03/unemployment-rates-by-educational-attainment/

Section 2: A Positive Return Takes Time

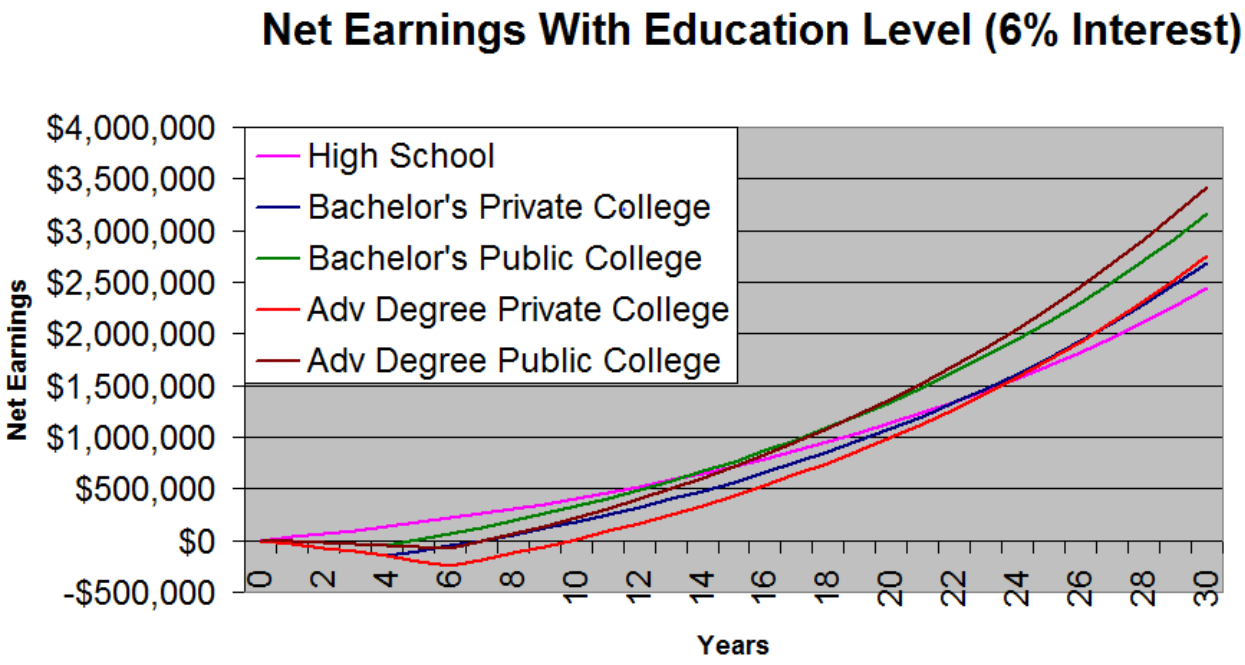
Men and women with Bachelor's degrees earn more than those with just a high school diploma. People with Advanced degrees earn more than Bachelor's degrees. Is the extra income that comes with the degrees worth the investment of time?

This analysis assumes room and board costs are equal for those working or attending school. The cost of attending school averages $34,730 per year for tuition and fees at private colleges versus $10,880 per year for tuition and fees at public colleges. Additionally, the hours worked per year average 1790 hours.

Individuals with Bachelor's degrees net earnings pass those with just a high school education between 10 year (public college) and 14 years (private college). Those with advanced degrees pass those with high school diplomas between 12 years (public college) and 16 years (private college). Individuals with advanced degrees from a public or private college pass the earnings of those with Bachelor's degrees from the same type of college between 15 years (public) to 18 years (private).



In reality, people in debt pay interest and people with assets get a return on their assets. We can add a 6% interest component which works against people in debt and works for those with assets.



When interest effects are added, individuals with Bachelor's degrees net earnings pass those with just a high school education between 14 years (public college) and 23 years (private college). Those with advanced degrees pass those with high school diplomas between 16 years (public college) and 24 years (private college). Individuals with advanced degrees from a public or private college pass the earnings of those with Bachelor's degrees from the same type of college between 19 years (public) to 27 years (private).

Strictly from a monetary point of view, the longer amount of time the extra income from higher education can effect net earnings, the more it makes sense to pursue Bachelor's and/or advanced degrees.

29) http://www.collegedata.com/cs/content/content_payarticle_tmpl.jhtml?articleId=10064
30) https://data.oecd.org/emp/hours-worked.htm

Part 11: Disclosure

The information presented here is the opinion of the author and may quickly become outdated and is subject to change without notice. All material presented in this document are compiled from sources believed to be reliable, however accuracy cannot be guaranteed. No person should make an investment decision in reliance on the information presented in here.

The ProFolio model portfolio results presented here are based on simulated or hypothetical performance. Unlike an actual performance record, simulated results do not represent actual trading and there is no market risk involved in the results. The simulated trades use historical data and therefore the trading algorithms are designed with the benefit of hindsight. In a simulated performance record it may be difficult, if not impossible, to account for all factors which might affect an actual performance record. Additionally, any account that ProFolio manages will invest during periods with different economic conditions than those under which the trading programs were developed. There is no representation being made that any account will perform as the hypothetical results indicate. In fact, there are often sharp differences between hypothetical results and actual returns subsequently achieved. Due to the benefit of hindsight, hypothetical performance almost invariably will show attractive returns, while actual results going forward may not be as attractive. As with all market investments, client investments can appreciate or depreciate.

The algorithm that created the trading signals for each of the portfolios used Exchange Traded Fund (ETF) historical data where possible. This ETF data had a limited history. To gain additional data history, the actual asset or index data was pre-pended to the ETF data. When this occurred, ETF expenses were subtracted from the asset or index data. Where asset or index data was not available, other correlated data, adjusted for expenses, was used. Model portfolio results include interest

and dividends, but subtract ProFolio's management fee (0.5%) and third-party brokerage custody/trading fee (0.25%). Real return is inflation adjusted. Higher returns generally come with higher risks. Model portfolio risk characteristics include maximum drawdown and volatility. Maximum drawdown is the portfolio's peak to trough prior to hitting a new peak and is a measure of downside risk. Volatility, or standard deviation, is a measure of the portfolio's price fluctuations both positive and negative. Sharpe ratio is a measure of return for a given risk. Sharpe ratio = (portfolio return - risk free return)/SQRT(portfolio return variance - risk free return variance).Where the risk free asset is the 90-day T-bill and the variance is the square of the standard deviation (or volatility). Tactical portfolios utilize cash or cash equivalents for risk management.

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